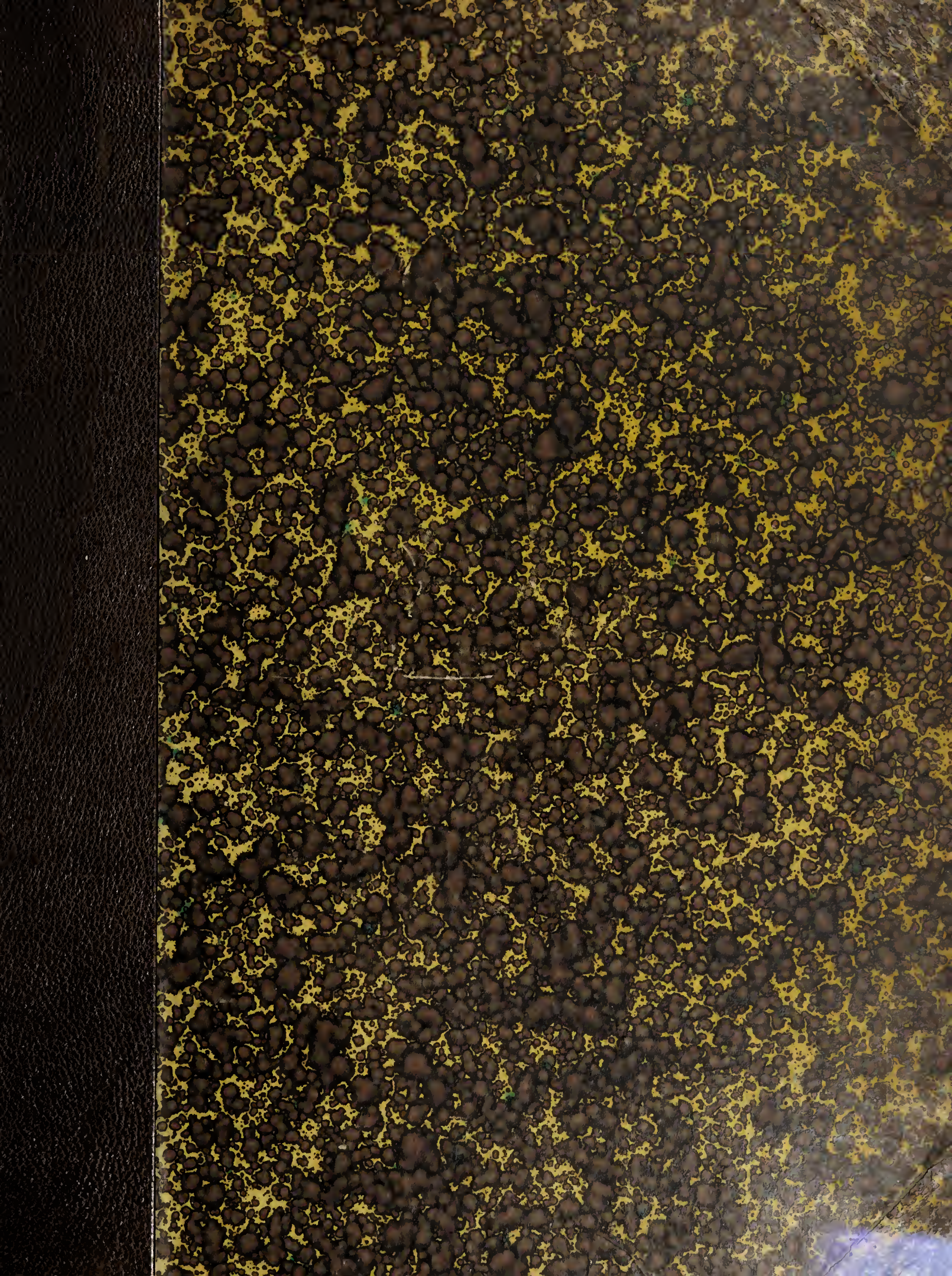




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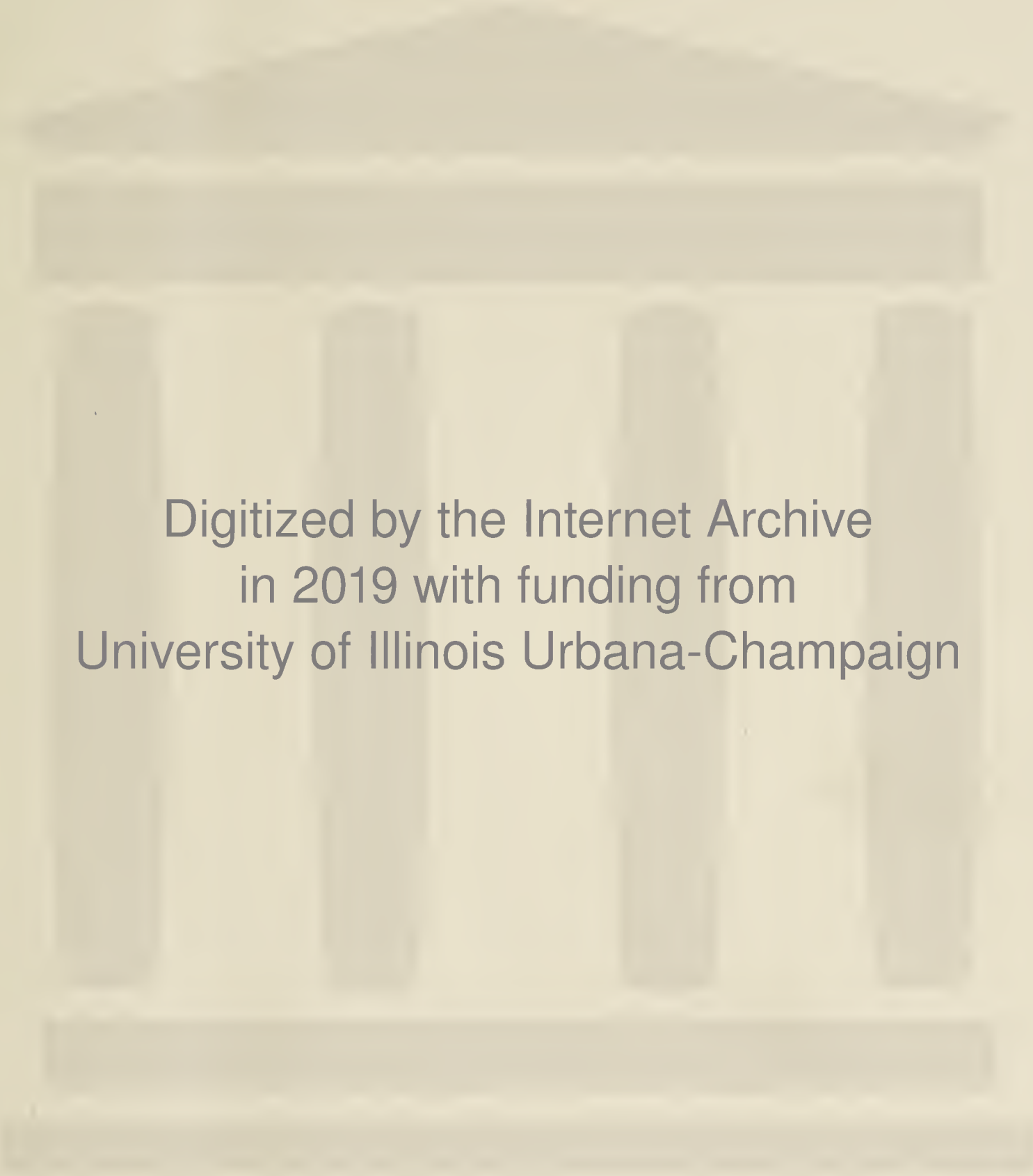
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CEMENT AND ENGINEERING NEWS

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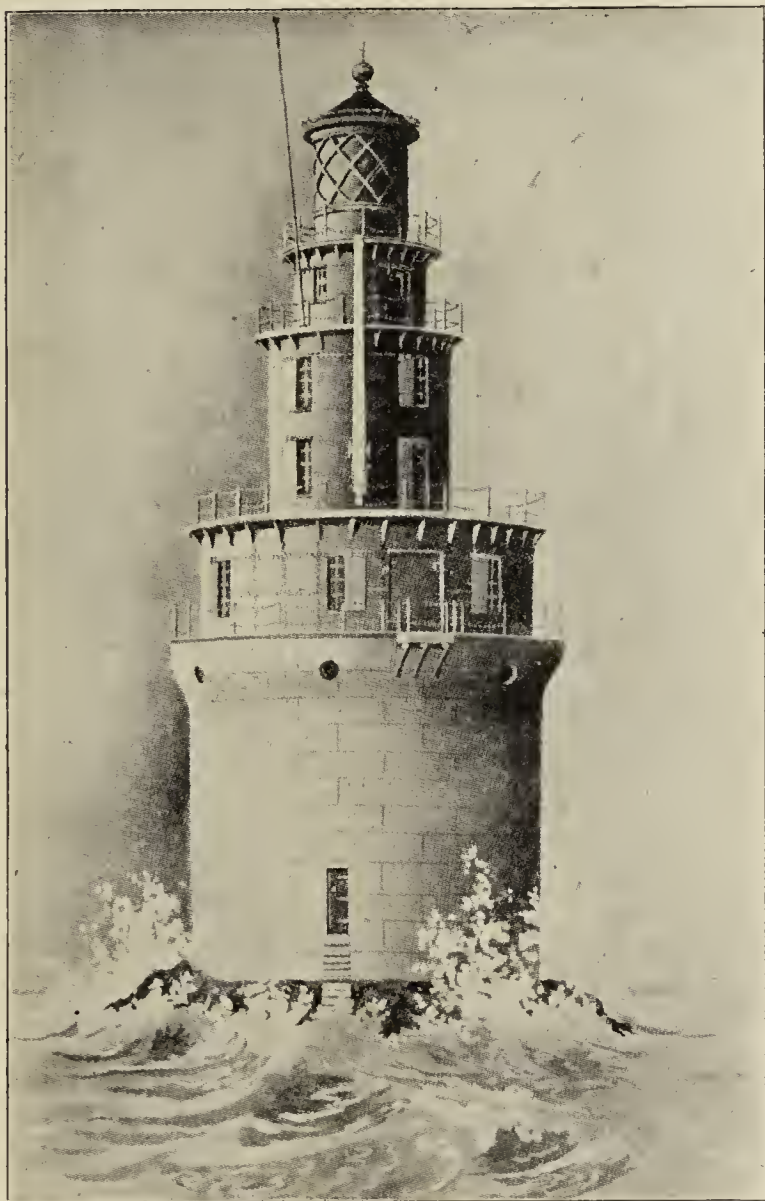
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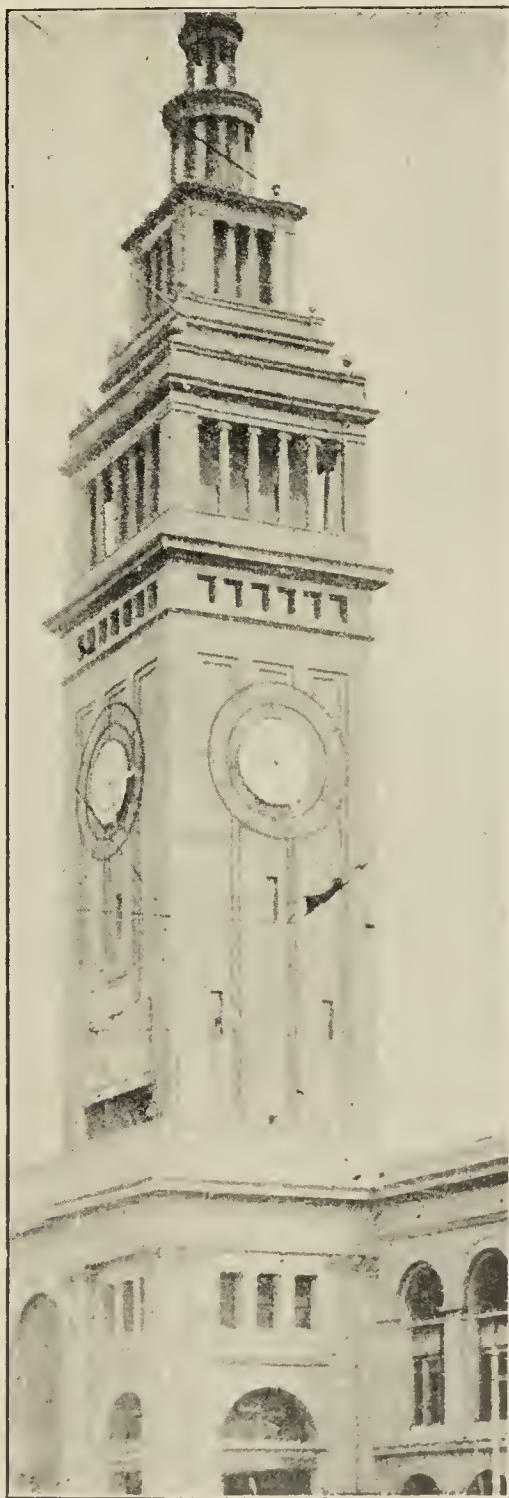
CEMENT

.....AND.....

ENGINEERING NEWS



Mile Rock Light Station, Near San Francisco Harbor.



100 Ft. Concrete & Steel Tower, Ferry Bldg., San Francisco.

CEMENT AND ENGINEERING NEWS

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CHICAGO, JANUARY, 1907.

CORRESPONDENCE.

We solicit correspondence on all matters of general interest to the cement trade in all its branches. Engineering notes, public improvements, and facts and opinions drawn from practical experiments will be welcome.

PROSPERITY IN THE CEMENT INDUSTRY.

All indications point to a prosperous season for both the manufacturers and consumers of Portland cement.

The steel industry which is now from four to six months behind orders is a certain indication and a forerunner of what may be expected in the cement industry. To the cement worker our advice is, purchase your stock of cement at present prices as cement will certainly command higher prices as the season opens. We look for a gradual increase in the cement market with the close of each month. The U. S. Government is now in sharp competition with the private consumers and it will pick up all of the cement it requires at good prices as soon as the season opens. It therefore behooves the individual consumer to lay in a stock at once, before the season opens. In Chicago there never was so much work on the architects boards calling for the exclusive use of cement as at the present time. Especially in reinforced concrete construction, the same is true of other large commercial centers. Concrete construction is now fully abreast of the increased output of the mills. The men who look for a decline in prices will be disappointed, all indications point to the contrary. Therefore take time by the forelock and buy in all the cement required while you can at the lowest prices for the year.

NATIONAL ASSOCIATION OF CEMENT USERS' CONVENTION.

The third annual convention of the National Association of Cement

Users convened at Chicago January 7th and continued to noon January 12th. The exhibits were housed at the 7th Regiment Armory, 16th and Dearborn streets. Every square foot of available space was taken, the machinery and appliances shown represented the latest advance in concrete construction. The machine manufacturers all report satisfactory sales. The business meetings were held at the Banquet Hall of the Auditorium Hotel where numerous valuable papers were read and discussed; several of these papers will be found in our present issue. The meetings and exhibits as a whole were the most extensive and successful ever held by the association. This opinion was freely expressed by the exhibitors and visitors alike.

The managers of the convention were themselves surprised at the magnitude of the display and were somewhat unprepared to meet all of the demands of such a convention. Yet there was little complaint, excepting that the power machinery made too much noise and should have been grouped together. The numerous gas engines at work sent forth vitiated air, which caused numerous headaches during the first day. There were many visitors from all parts of the country. Had the convention been suitably advertised the attendance could have been more than doubled from Chicago alone. The local daily press gave only scant recognition of the existence of the convention. This we hope will not be overlooked in the future. These few drawbacks did not mar the convention as a whole; on the contrary, it was a decided success.

THE NORTHWESTERN CEMENT PRODUCTS ASSOCIATION CONVENTION.

This association held its third annual convention at St. Paul in the Armory Building on the 16th, 17th and 18th of January. The attendance was large and the machinery display greater than at any previous convention. Martin T. Roche, secretary of the association, was untiring in advancing the interest of the convention, as was H. A. Rogers, O. U. Miracle and C. A. P. Turner, president of the association. On Thursday morning the Miracle Pressed Stone Co., of Minneapolis, invited the association to visit its extensive works at Minneapolis, over 200 members taking advantage of the invitation took cars at St. Paul for Minneapolis, where they were conducted through

the Miracle pressed stone plant, where the Miracle system of manufacturing cement block, sewer pipe, window caps and sills, steps and other concrete specialties were in full operation. Refreshments and cigars were served at the works. The trip was instructive and pleasant throughout. At 1 p. m. the return trip was made to St. Paul when the convention resumed its deliberations. Many valuable papers were read during the session. The convention elected the following officers: President, Lee Stover, Watertown, N. D.; Secretary, Martin T. Roche; Vice Presidents, A. H. Laughlin, Lisbon, N. D.; O. U. Miracle, Minneapolis; C. A. P. Turner and John Wunder, both of Minneapolis; Wm. Simpson, Mandan, N. D. The Miracle Pressed Stone Co. was awarded the first prize for the best and most complete display of concrete machinery at the convention.

IOWA ASSOCIATION OF CEMENT USERS' CONVENTION.

This association held its third annual convention at The Iowa State College, Ames, Iowa, covering January 23 to 25 inclusive. The following papers were read and discussed.

"Demonstrations of Cement Tests," by F. C. French, Ames; "The Use of Cement in Drainage" by Engineer A. J. Lilly, Algona; "The New Cement Factories" by Professor S. W. Beyer, Ames; "Cement Post Data," by A. O. Anderson, Lake City; "Standard Sand for Use in Cement Work," by M. J. Reinhart, Ames; "Concrete versus Wood for County Culverts and Bridges," by Jas. Austin Mortland, Montezuma; "Finish for Concrete Surfaces," by H. H. Quimby, Engineer of Bridges, Philadelphia; "Cement and Concrete in Highway Work During 1906," by T. H. MacDonald, State Highway Commission, Ames; "Monolithic Construction and Exterior Finish for Buildings," by P. P. Comoli, Sioux City; "Tests of Cement Block," by Professor A. Marston and M. I. Evinger, Ames; "Notes on the Investigations of Cement Mortars and Concretes at the United States Geological Survey Laboratories at St. Louis," by R. L. Humphrey, President National Cement Products Association, Philadelphia; "Selecting the Proportions for Concrete," by William B. Fuller, New York; "Development of the Cement Industry," by R. G. Coutts, Grinnell.

Several of the papers were illus-

trated by lantern slides. The attendance was large. The machinery exhibits were small on account of the short time intervening between the Northwestern Cement Products Convention at St. Paul and the Iowa Convention at Ames, it being impossible to get the machinery to Ames. This was unfortunate as there were many prospective purchasers in attendance. The following officers were chosen for the ensuing year: Geo. H. Carlin, president, Oskaloosa; D. P. Faus, first vice president, Waterloo; Geo. R. Ross, treasurer, Grinnell; Ira A. Williams, secretary, Ames, Iowa.

NEBRASKA CEMENT USERS' ASSOCIATION.

The second annual convention of the above named association will be held at Grand Island, Neb., Feb 6, 7 and 8, 1907. Some 23 spaces for the exhibition of machinery. For further particulars address F. Berger, Pres., Hastings, Neb., or R. J. White North Platt, Neb. 200 members of the association are expected to be in attendance. W. F. Roney, of Grand Island, Neb., can be consulted for exhibition space.

A Portland cement company is being organized at Fort Scott, Kansas. Eight barrels of cement material taken from the proposed site of the works have been shipped to Ohio to be tested to determine its value as raw cement material.

The Lawrence Cement Co. gave its sixth annual banquet to the superintendent and foremen of the various departments of the plant on January 4th at the company's offices at Siegfried, Pa. Seven courses were served. S. Van Nuddlesworth, secretary of the company, delivered an appropriate address. A letter from the president was read, complimenting the working heads of departments on the valuable services rendered.

A bill has been introduced in the Indiana legislature to prevent the dredging of marl from lakes having an area of more than 640 acres. This would effect the Sandusky Portland Cement plant at Syracuse, Ind. and the Wabash Portland Cement Co. plant at Stroh, Ind. The bill is known as Attorney General Miller bill to protect Indiana lakes.

DEATH OF RALPH I. GATES.

Ralph I. Gates, late secretary of the Chicago Portland Cement Co., died on January 16th at his home, 4457 Ellis Ave., Chicago. Mr. Gates was a pioneer in the American Portland Cement industry. In 1887 Mr. Gates organized the Anglo American Portland Cement Co., and after failure to make cement from native materials, began to import English Portland cement clinker which was ground in Chicago. There being no duty on clinker at the time. Subsequently a duty being placed on clinker, he gave up the importing of the same and renewed his efforts to manufacture cement from American materials, which was successful, with the assistance of the late David R. Frasier and Norman D. Frasier, which finally developed into the Chicago Portland Cement Co.

Mr. Gates experimented with and built several rotary kilns in 1885 fired with oil, but could not produce practical results because the kilns were only about 15 feet long.

Mr. Gates was born in Chicago January 31st, 1842, and was the son of the late Philetus W. Gates, founder of the Gates iron works.

PURIFICATION OF BOSTON SEWAGE.

The U. S. Geological Survey has published the report of Messrs. C. E. A. Winslow and Earl B. Phelps on the purification of Boston Swage, under the direction of the Massachusetts Institute of Technology, which established a sanitary research laboratory and sewage experimental station on the main trunk sewer of the south metropolitan system of the city of Boston. Mr. T. Sedgwick was made director of the work with Mr. Winslow as biologist and Mr. Phelps as research chemist.

The present volume contains, first, a careful and elaborate historical review of the whole sewage-disposal problem from its origin in the wide adoption of the water-carriage system up to the present time, when that system has become practically universal.

Following the historical review is a full description of the experiments thus far made on the sewage of a great American seaboard city, together with comparisons with similar work done elsewhere, with practical conclusions which have been drawn from the experiments and specific statements concerning the comparative merits of various systems of purification tested. These are by no means applicable merely

to large cities or to seaboard cities, but contains lessons of practical value for all sorts of communities.

This report is published by the Geological Survey as Water-Supply and Irrigation Paper No. 185. It may be obtained, free of charge, on application to the Director of the United States Geological Survey, Washington, D. C.

The Sandusky Portland Cement Company, of Syracuse, Ind., is reported to have obtained options on land surrounding Dewart and Milford lakes, and will work the marl beds at these points. A narrow gauge road is to be built from the factories to the lakes named. Opposition from the owners of cottages at Lake Wawasee is anticipated.

The Lehigh Portland Cement Co. has purchased the Mitchell Lime Co., of Mitchell, Ind., consisting of lime kilns and quarry at Rabbittville and kilns and quarries on Rock Lick and office building on Main street, Mitchell, Ind.

Union City, Mich.—The Peerless cement plant has shut down after a run of 11 months, during which time 375,000 barrels of cement were manufactured.

The annual meeting of the Egyptian Portland Cement Co. was held on January 8th at Fenton, Mich. The old board of directors was re-elected by the stockholders with the exceptions of Flint P. Smith and George W. Hubbard, of Flint, who resigned. Their places were filled by the election of W. E. Braman, of Flint. Meeting was entirely harmonious, and the company starts out with the prospect of a prosperous year.

F. C. Fisk, chief engineer of the Lehigh Portland Cement Co., has been closing options on the property north of this city which his company has held for some time. It is definitely decided upon and work will be commenced in the spring with a force of 1,000 men in the construction work. It is estimated that the cost of the new plant will be one and a half million dollars and have a capacity of 2,500 barrels per day, giving permanent employment to 400 men. This makes the third cement plant for Mason City, Iowa, and the fourth in sight.—Mason City Republican.

WATERPROOFING.

Mr. H. Wiederholdt, Mr. President and Members of the National Association of Cement Users:

By invitation of your president I have been asked to speak to you to-day on the subject of "Waterproofing." It is especially gratifying to me to be asked by a gentleman who has known me for a long period of years, and who knows the nature of the work that I have done as manager of our company.

One of the largest pieces of work done in the "city of brotherly love," was the widening of Delaware avenue, and in connection with the same the concrete sea wall along the Delaware river, which was done by our company while your president was with the department of public works. Hence, I am justified in supposing that our efforts at that great piece of work, as well as at others which came under his immediate attention while he was connected with the department of public works, were approved by him, and hence warranted him in conferring upon me the honor of addressing you to-day.

Waterproofing, and especially waterproofing with asphalt mastic, is my theme. I have had the pleasure of speaking to various engineering societies; yes, even to the Western Society of Engineers in this city, on the same subject; but I have never had the opportunity of addressing a body of men of my own stripe; men who not only plan in their cushion covered office chairs ways and means to do a certain difficult line of work, but on whom it devolves to go and execute these various tasks. You all, indeed, have experienced that to plan and devise a piece of work is one thing and to execute it is often quite another.

We all, I know, swear by cement, and some of the older ones, among whom, I am sorry to say, I have to count myself, know how foreign cement domineered this country and what a hard fight we had to wrest the supremacy from foreign cement in our market, and how we finally succeeded. But I am proud to say that to-day American cement, made from America's own native product, in American mills, and by American ingenuity, now rules our market. Yes, I may go further and say it is making vast inroads in foreign countries and is proving a strong competitor to English and German cements. In our own country I might say that we have driven them from their last ditch.

What immense progress has been

made in the use of cement is known to you all. To say that the whole usage of cement has been revolutionized is putting it mildly. Who dreamed ten or fifteen years ago that we would rear skyscrapers, build bridges, and do almost everything imaginable with cement, or make inroads on steel and stone construction?

You must admit too often in your work the time has come when you were compelled to find some material which would waterproof your foundations for buildings or waterproof your bridges; keep out dampness; not easily disintegrate when in contact with water; not be affected by climatic changes, and which stands heat and cold without cracking; protecting your iron constructions, no matter of what nature they be; meeting requirements for sanitary floors, water closets, kitchens, sub-basements, breweries, and, in fact, for any kinds of floors where water is used to a great extent, and where floors have to be water tight. You all know, as well as I, that cement will not and cannot fill the bill.

In order to obtain the best results for waterproofing of the last twenty-five years in my researches in this and foreign countries. But do not think for one moment, however, that I shall use the courtesy extended to me of speaking to you to-day as a cheap advertising scheme for any certain material. No, gentlemen, I would not violate in that manner the common rules of etiquette. The material of which I am going to speak is in the open market and can be bought by all of you in the same manner as any other product.

Asphalt mastic I have found to be the most efficient material for waterproofing. Now, a great many of you have used asphalt mastic and know all about it, but, I have found by experience that there are also a large number of architects and men in the business who know little or nothing about this valuable material, and this was my reason for delivering the various lectures on the subject.

I shall refrain from reciting to you how asphalt mastic was used in the olden times, how even the fishermen of Galilee used it to make their boats water tight, that in Greek it was called "asphaltos," in Latin "bitument," and in German "erdpeck." I shall not tire you with a lot of ancient history, as we are dealing with the present and not with the past.

Rock asphalt is found in Val Travers, or Val de Travers, in the Canton Neuchatel, Switzerland.

In Seyssel on the Rhone, in the French department of de l'Ain.

In Lobsann, a little village of the North Elsass.

At Limmer, a small town near the city of Hanover.

At a small town, Vorwohle, in Braunschweig.

And at Ragusa, on the south coast of Sicily.

The rock asphalt of the above mentioned different mines consist of about 70 to 85 per cent of carbonate of lime, 8 to 15 per cent of bitumen, a small proportion of oxygen of iron, and a small proportion of carbonate of magnesia. While I have at my command, and would give you the analysis of each of the different rocks mentioned, I shall refrain from doing so, as I wish to be fair with all rocks.

The proper and only way to prepare the asphalt mastic correctly—by this I mean the marketable article which is ready for shipment or use—is in the first place to have the rock, as it comes from the mines, picked and sorted, and to have those portions of the rock which are not thoroughly impregnated with bitumen thrown to one side. With a little experience and judgment this can easily be done. The rock, after being broken into pieces, either by machinery or hand, to about the size of nut coal, is thrown into a disintegrator and pulverized to a fine powder. The flux (neither light volatile oils nor coal tar, but a flux of pure bitumen refined from the best possible asphalts, Bermudez or Trinidad) in proper proportion is placed in specially built melting tanks and subjected to indirect heat and continuous agitation; and, after being thoroughly heated and made perfectly fluid, the pulverized rock is added to the same. The kettle is now closed, and this mixture is left to cook for from four to six hours, at a heat of at least 250 to 300 degrees Fahrenheit. An experienced eye knows when the mixture is ready to be drawn off into molds. These molds are either square, round or octagon in shape, according to the manufacturer's trademark, and each one having a capacity of about 50 or 60 pounds of mastic.

After the mastic so drawn off has sufficiently cooled, and having been stamped with its brand, it is taken from the molds and is now ready for shipment.

I cannot help but express that, in my estimation, it is by far the safer way to import the rock in its crude state to this country and manufacture the mastic here, rather than

to try the manufactured article, as in the latter instance you are more liable to buy a "cat in a bag," as adulteration can easily be practiced on you by your European brethren. Especially have I been strengthened in this opinion since my last visit to Europe.

The prepared asphalt mastic is now ready to be brought into use by the asphalt mastic operator, and now the judicious manipulating by the experienced workmen begins. Placing the right amount of mastic, fluxing the same with the proper ingredients, adding the right amount of grit, and perhaps some sand, just as it may be required by the proposed work, the material is kept cooking under continual stirring, and is ready for use whenever a wooden stick inserted in the mixture comes out perfectly clean, no material whatever adhering to it. It is then spread with the help of wooden spatulas or floats, to the required thickness on the prepared foundation, and after having cooled sufficiently is rubbed with the help of fine sand and sandstone to a smooth surface.

By no means am I, or anyone familiar with the mixing of the mastic, able to give you a uniform mixture to be used for all floors and waterproofing. The mixture depends entirely on what use the floor is to be put to, as it requires different mixtures for various purposes, and it is here that the experienced workman comes in.

Great care must be taken to ascertain what is required of the floor to be laid; whether it is to be used under or out of water; whether acids, if so, what kind, are to be used on the same, whether the room is to be kept cold or warm; and, in fact, only after taking everything into consideration, can the mixture be decided upon.

An asphalt floor, by long odds, is more advantageous and will yield better results in cellars or ground floors where the moisture of the underlying ground may effect the floor.

Also a cement or any other floor absorbs the moisture, and takes a long time to dry if cleaned with water. To verify this assertion I had a piece of cement pavement one foot square by one inch thick weighed when perfectly dry, and found that it weighed 20 pounds 12 ounces. I then laid it in water for a period of twenty-four hours, and again weighed it, and found that it had absorbed 1 pound 8 ounces, making a total weight of 22 pounds 4 ounces.

I did exactly the same thing with a piece of asphalt mastic flooring of

the same size and in twenty-four hours it absorbed only one and one-half ounces.

Natural deposits of rock asphalt have also been discovered in our own country, namely, in Kentucky and in Indiana Territory. Our company has gone to a great deal of expense in experimenting with these rocks; yes, we shipped right into this city at a great cost a car of rock from Indian Territory, and I myself experimented with the same, and we found that rock from either Kentucky or Indian Territory will not make good asphalt mastic, and as much as we dislike, we must depend upon the product of the European mines for pure rock and rock that will not disintegrate.

In my experience I do not know of any material in existence that has been so much sinned against as asphalt mastic. Any one who has money enough to buy a barrel of coal tar and a pot to melt it in can mix this material with sand, and then call it genuine rock asphalt. Cheap oil asphalts are often used in the production of asphalt mastic, and the unsuspecting architect and general contractor are deceived. If work done with this kind of material does not turn out to be water tight or disintegrates in a short time, asphalt mastic is condemned, and is pronounced no good. I, however, positively defy contradiction, may it come from an architect, an engineer, or a worker in asphalt mastic, when I say that if genuine asphalt mastic is used, it will do all that I claim it will. Still your architect will tell me, "I have specified asphalt mastic; yes, I have even gone so far as to use specifications made by you, and still it did not do the work." Your general contractor will say, "I have used asphalt mastic, and it has fallen far below what I expected it would do." I have asked, and do ask now, whether you have used genuine rock asphalt, or something

which has been panned off on you as the genuine article. I assure you that in every case that did not give satisfaction some other material than asphalt mastic was used. To prove to you that I mean just what I say, let me cite to you a few of the many instances which have come to my observation during my business career, and which I can substantiate, if so desired, by giving the name of the architect, the building and the place.

A large tunnel was to be constructed from one building to another in one of our principal hospitals in Philadelphia. It was to be used as a passage way for the nurses, and also to carry the steam pipes from one building to another. Asphalt mastic was specified for the waterproofing, and we bid on the work. The contract, however, was given to another contractor for less than it would cost us for the material. After the work was finished and the steam which was to be carried from one building to another was turned on, the heat naturally caused contraction in the cement walls down to where the waterproofing was placed, and before long the beautiful, so-called pure asphalt mastic began to run out in little streams on the floor of the tunnel, and the nurses and attendants naturally carried this so-called liquid asphalt mastic throughout the building and into the sick chambers—a very pretty state of affairs. The architect insisted on my going with him to investigate the cause. I was satisfied and could have told him what had caused the trouble before we went, but to please him I consented to go, and I found exactly what I had expected. To convince him that no asphalt mastic had been used; I just held a lighted match against some of the material and the odor and the way it ignited soon convinced him that the supposed water-

IMPORTS OF CEMENT INTO THE UNITED STATES.

WHERE FROM	NOVEMBER				ELEVEN MONTHS ENDING NOVEMBER 1906.			
	1905		1906		1905		1906	
	Quantity in lbs.	Value in Dollars	Quantity in lbs.	Value in Dollars.	Quantity in lbs.	Value in Dollars.	Quantity in lbs.	Value in Dollars.
United Kingdom . .	108,000	\$ 299	5,884,208	\$ 18,185	13,529,400	\$ 42,632	160,262,664	\$468,800
Belgium	7,046,965	20,403	36,102,268	104,176	118,122,686	371,047	224,172,491	729,046
France	994,360	4,107	5,155,418	19,556	6,755,760	25,037	14,127,900	50,180
Germany	36,110,629	108,880	33,512,636	98,822	167,461,532	555,920	278,737,457	890,588
All Other Europe . .	—	—	19,063,600	55,320	240,659	609	19,361,853	56,240
British North Am. .	—	—	504,760	3,624	165,110	1,591	3,835,833	27,077
Other Countries . .	990	7	6,509,800	33,245	470,515	1,790	72,796,104	335,740
TOTAL	44,210,854	133,696	106,723,690	332,928	306,745,662	998,626	773,294,302	
Domestic Exports of Cement, bbls. . .	68,129	96,920	69,313	122,803	945,645	1,290,961	549,631	891,083

There were 5,777,730 lbs. of imported Roman and Portland Cement, etc., in the United States bonded warehouses in November, 1905, valued at \$17,292, against 10,733,241 lbs. in November, 1906, valued at \$34,355.

For eleven months ending in November, 1905, there were 84,709 tons of asphalten imported in the United States, valued at \$964,015, against 94,675 tons imported in eleven months ending November, 1906, valued at \$379,485.

proof asphalt mastic was nothing more than coal tar mixed with sand.

A certain architect who prides himself on having built more Y. M. C. A. buildings in our part of the country than any other architect designed a Y. M. C. A. building for Coatesville, Pa., and one for Niagara Falls, N. Y. Naturally every Y. M. C. A. building has to have a swimming pool, as we all know that cleanliness is next to godliness. These buildings were built and we were asked to bid on the swimming pools. On the swimming pool for the Y. M. C. A. building at Coatesville we bid without success, on account of the price. Coal tar or oil asphalt is cheaper than asphalt mastic and our bid was considered too high. The first time the hot water was turned on the glazed brick which formed the inner lining of the pool, back of which the supposed asphalt mastic was laid, even these bricks thought that they might enjoy a dive in the pool, and as nothing but oil asphalt was holding them to their places they could readily have their desire, so down they came. The architect came to me and in a surprised manner said: "I used your specifications."

My natural answer was: "I am exceedingly sorry, but pray did you use asphalt mastic?" Out from the architect's pocket came a sample of what he supposed was genuine asphalt mastic. It did not take a chemical analysis to determine what the material was. Pardon me for using slang, but I had been up against it before, and my lighted match again did the trick and convinced the architect the asphalt mastic had been made out of oil asphalt. Just about that time we were again called to Coatesville by the president of the town council, and on meeting him he informed me in a pleasant way that the reservoirs which we had lined eight years ago for them had stood so well and had not cost them one dollar of expenses during all these years, that they desired to give us the third reservoir to line with asphalt mastic. I used this opportunity to investigate the swimming pool in the Y. M. C. A. building at Coatesville, and the least that I can say is that it was a pitiful sight to see the otherwise well constructed swimming pool completely spoiled by the use of improper waterproofing materials.

I did not see the swimming pool at Niagara Falls and can only say from hearsay that it was in about the same condition as the one at Coatesville. Since then the same architect has designed another Y. M.

C. A. building at Hazleton, Pa., but he has inserted plainly in his specifications that the swimming pool shall be built by us.

But not alone adulteration of asphalt mastic is proving a snag in the waterproofing business. The various kinds of paper, burlap and some great inventions which you simply squirt against the wall which is leaking, have been extensively advertised, and have been used with perhaps some success. I am not here to condemn any of them, and I do not wish to tramp on anyone's toes, but I certainly have the right to tell you my experience regarding some of these materials.

When the first part of the subway in Philadelphia (that is, from Fifteenth street west to Schuylkill river) was to be built, I was invited to meet the president and the chief engineer of the Philadelphia Rapid Transit Company regarding the waterproofing and finally asphalt mastic came out victorious. We did the work and so far not a single leak has been found. When the second portion (that is, from Fifteenth street east to the Delaware river) was to be given out, strong influence was brought to bear by a paper and compound company, and I had no light task in convincing the officers of the Philadelphia Rapid Transit Company that paper would not do.

You all know that to hold up the roof of a tunnel there must be placed at certain intervals supports of heavy timber, and the waterproofing must be done around these supports. After the waterproofing has sufficiently hardened the supports are moved on the waterproofing and the spaces which they occupied have then to be waterproofed. This you can readily see cannot be done effectually with paper. It would simply mean a patched job, and we all know that a patched pair of pants is not as good as those made out of the whole cloth.

It is quite different with asphalt mastic, however, as all that is needed is to heat the sides of the first laid mastic and then apply new asphalt mastic, and you can make a joint which the most experienced mastic layer afterward cannot find, and in that way you get a perfect monolithic and continuous sheet. On this very essential score we were awarded the contract for the second portion of the subway, and we are now laying asphalt mastic from Fifteenth street down to the Delaware river over the whole length of the tunnel.

The subways in New York and Boston are lined with paper and asphalt compounds, and you can

readily ascertain whether they are water tight. As we laid all the cement work at the various underground stations of the New York subway, I can say from my own observations that the tunnel is not water tight, and from what I have heard the Boston subway is not much better.

About nine years ago we laid a saw-toothed roof on the Fidelity building, Philadelphia. On the sharp incline five-ply paper and compound were specified, while on the other part of the roof asphalt mastic was specified, and over all this was laid a layer of cement. Some time ago a leak was sprung in the roof, and on cutting down the cement we found the asphalt mastic intact, and in the same condition as when we laid it, but the paper disintegrated and caused the leak.

I could tell you a number of experiences that I have had with waterproofing with paper and coal tar or asphalt compounds, but I simply wish to say that we give a guarantee with all our asphalt mastic work, but we refuse to give any guarantee with paper.

Another one of my experiences which I wish to cite to you is in connection with the swimming pool for the Blind Asylum at Overbrook, near Philadelphia, which was to be built last summer in connection with the bowling alley. We bid on this work, and the contractor wanted us to build the pool, but our competitors bid so low that we could not possibly do the work at their price; hence we lost the contract. The first contractor did his work in such an unsatisfactory manner that the architect made him relinquish the contract. Another party next tried his hand with burlap and compound, but was so unsuccessful with his work that it leaked like a sieve and we were called in to do the job. We began by tearing out all the materials and lined the pool with asphalt mastic. We have now completed the work and have guaranteed it for five years.

The new home of the Racquet Club is now being built in Philadelphia and between the third and fourth floor a large swimming pool is planned, for which we have the contract, and which we expect to line with asphalt mastic.

When waterproofing is to be done in places where there is considerable water pressure we find that there is only one method to pursue. While doing the work relieve the water pressure by pumping from a lower water level. Build your bottom and outer walls of sufficient strength to receive the asphalt

mastic waterproofing or lining. Then build your concrete bottom and inner brick and concrete walls on top of the asphalt mastic lining and of sufficient weight to withstand the water pressure from without, and your task is done.

At the new Wanamaker building in Philadelphia we are building approximately 1,700 lineal feet of pipe ducts below the sub-basement floor, which are almost completely submerged in water. We are building them in the manner above described with the best of success.

I speak, as stated above, from experience, and I could easily recite to you many cases where we have been called in to do the work where others have failed.

Before I close I wish to state that I have with me samples of crude rock asphalt, and also of asphalt mastic in marketable form, as well as pictures of some of the work which we have done, and I shall be only too pleased to show them to anyone who wishes to see them, and if any of my remarks need further explanation to anyone I shall be only too glad to have them question me, and if I have spoken disparagingly of anyone's material I am sorry, but I was called upon to tell you my experience and I have done so without malice.

I thank you for your kind attention.

FORMS FOR CONCRETE CONSTRUCTION.

By Sanford E. Thompson,* M. AM.S.C.E.

Recent failures in reinforced concrete construction cannot be cast one side and forgotten with the passing comment so frequently heard that the accident was due merely to poor construction or too early removal of forms. The reasons for every failure should be thoroughly investigated by experts to prevent recurrence of similar accidents.

"Forms," although frequently guilty, are by no means the only culprits. In fact they are frequently blamed when the designer is at fault. Just so long as men who know nothing of the first principles of mechanics are permitted to design concrete structures, and just so long as irresponsible contractors are engaged to erect them, the list of accidents will increase in startling numbers. In every case it is the men, not the inanimate lumber and materials, who are to blame.

However, granting its danger under ignorant hands, reinforced concrete as a whole must not be condemned for failures due to improper conditions any more than brick should be rejected as a building material for apartment houses, because of the collapse of several unfinished buildings in New York City two years ago through disregard of frost action upon the mortar.

Failures in concrete buildings may be attributed to:

(1) Imperfect design; especially through neglect of essential details in locating the reinforcing metal, and through the adoption of too low a factor of safety.

(2) Poor materials; such as cement which does not properly set up, or sand which is too fine or which has an excess of clay, loam or other impurities.

(3) Faulty construction; from improper proportioning, mixing or placing, or too early removal of forms.

(4) Weak forms.

A disregard of such important principles is frequently criminal negligence, and yet in at least one case under my observation, an examination of the structure and the materials, after a collapse in which a number of lives were lost, showed both the design, materials and construction so faulty that it was impossible to decide positively which of the four causes named above was the primary reason for the failure.

In this paper it is proposed to treat only of the design, construction and removal of forms.

Kind of Lumber: The selection of the lumber must be governed by the character and the local market. Although white pine is best for fine face work, and quite essential for ornamental construction cast in wooden forms; for ordinary work, however, even for the panels, white pine is apt to be too expensive, and spruce, fir, Norway pine or the softer qualities of southern pine, especially North Carolina pine, must be substituted for it. Some of these woods are more liable to warp than white pine, but they are generally stiffer and thus better adapted for struts and braces.

Kiln dried lumber is not suitable for form construction because of its tendency to swell when the wet concrete touches it. Very green lumber, on the other hand, especially southern pine, which does not close up quickly when wet, may give trouble by joints opening. Therefore, the middle ground, or in other words, partially dry stuff, is usually best.

Finish and Thickness of Lumber: Either tongued-and-grooved or bevel-edged stuff will give good results for floor and wall panel forms, and is preferable to square-edged stuff. A smoother surface may be attained at first with the tongued-and-grooved stock, and there is less trouble with opening joints, but it is more expensive than bevel-edge because of the waste in dressing, and if the forms are used many times, there is greater tendency to wear at the joints. Even for rough forms, plank planed one side may be economical or cheapen the cost of cleaning. Studs should always be planed one side to bring to size.

The thickness of the lumber varies with different contractors, some using 1 inch, others 1½ inch, while a few employ 2 inch stuff even for panels. (These are commercial thicknesses measured before planing.) For ordinary walls 1½ inch stuff is good, although for heavy construction where derricks are used, 2 inch is preferable. For floor panels, 1 inch boards are most common, although if the building is 8 stories high or over, 1 inch stuff is likely to be pretty well worn out before the top of the building is reached and the under surface of the concrete may show the wear badly. For sides of girders either 1 inch or 1½ inch is sufficient, while 2 inch is preferable for the bottoms of girders. Column forms are generally made of 2 inch plank.

Certain general rules are applicable to all kinds of forms. Strength, simplicity and symmetry are three fundamental principles of design. The necessity for strength is obvious while economy in concrete construction consists in quickly erecting and moving the forms and in using them over and over again.

The design of the concrete members should recognize the forms. A slight excess of concrete sometimes may be contributed to save carpenter work. Frequently beams may be designed of such widths as to use dimension widths of lumber without splitting.

Columns may be of dimensions to avoid frequent re-making. Panel recesses in walls may be made the thickness of a board or a plank. To permit ready cleaning of dirt and chips from the column forms before laying the concrete, at least one prominent contractor provides a door at the bottom of each of them.

In building construction the forms must be designed so that the column molds and also the bottom of beam molds are all independent of the slabs. The forms may thus

*Consulting Engineer, Highlands, Mass.

be left a longer time upon members subjected to the greater stress.

The sides of the beam molds should be held tightly together by wedges or clamps, to prevent the pressure of the concrete springing them away from the bottom boards. At top or bottom of each strut hard wood wedges are useful when setting and removing it and also permit testing to make sure that there is no deflection of the beam or slab. For this purpose some contractors loosen the wedges twenty-four hours in advance of the struts. In general it is preferable to use comparatively light joists, such as 2x8 inches or 2x10 inches, with frequent shores, rather than to use lumber which is heavier to handle.

If forms are to be used but once or must be taken apart when removed, it is sometimes practicable to use only a few partially driven nails so that they can be withdrawn without injury to the lumber. It is very difficult to convince house carpenters that the pressure of the concrete will hold temporary panel boards in place with scarcely any railing.

Alignment is another item of importance since it is here that a great deal of time may be wasted by inexperienced or incompetent carpenters. Such workmen may err either on the side of poor alignment or more careful alignment than the structure requires. Mr. W. J. Douglas* suggest as a general rule the allowance of "3-inch departure from established lines or finish work and 2 inches on unfinished work."

In removing forms the green concrete must not be disturbed by prying against it. This seems so obvious as to need no emphasis, but I have known a first-class house carpenter to actually attempt to straighten a wall which was an inch out of line, the day after the concrete was laid by prying the forms over. The wall was straightened, but by a different process from that proposed by the carpenter—the concrete was relaid.

Forms for facework should be tightly put together, it being advisable in some cases to close the joints and holes by mortar, putty, plaster-of-Paris, sheathing paper or thin metal. This is not, as is commonly supposed, to prevent loss of strength by the cement which flows out with the water, but rather to prevent the formation of voids or stone pockets in the finished surface.

Crude oil is one of the best materials to prevent adhesion of the

concrete to the forms, though linseed oil, soft soap and various other greasy substances are also employed for this purpose. The oil or grease should be thin enough to flow and fill the grain of the wood.

If the forms are to be left until the concrete is hard, there is little danger of the concrete sticking to them if instead of being greased they are wet thoroughly with water before the concrete is laid. In any case, if concrete adheres to the forms it should be thoroughly cleaned off before resetting; even then it is apt to stick again in the same place.

"Rule of thumb" layout of forms in the field is being superseded by design in the drawing room. In building construction where the forms form a large percentage of the cost of the building and where a failure in the forms may cause loss of life, it is especially necessary to treat this question from an engineering standpoint, and many of the best concrete contractors now design their forms as carefully as the dimensions of the concrete members.

If a minimum quantity of lumber is to be used consistent with the deformation allowed, it follows that the dimensions and spacing of the supporting lumber must be actually computed from the weight or the pressure may be calculated as a liquid. Mr. W. J. Douglas* assumes that the concrete is a liquid of half its own weight, or 75 pounds per cubic foot.

In ordinary walls where the concrete is placed in layers computation is not usually necessary, since general experience has shown that maximum spacing for 1-inch boards is 2 feet, for 1½-inch plank is 4 feet, and for 2-inch plank is 5 feet. Studding generally varies from 2x4 inch to 4x6 inch, according to the character of the work and the distance between the horizontal braces or walling.

Floor forms are better based upon an allowable deflection than upon strength, in order to give sufficient stiffness to prevent partial rupture of the concrete or sagging beams.

In calculating, we must add to the weight of the concrete itself, i. e., to the dead load, a construction live load which may be assumed as liable to come upon the concrete while setting. Definite units of stress must also be assumed in the lumber.

I would suggest the following

basis for computation, these being values which I have adopted after quite thorough consideration of the matter:

(1) Weight of concrete including reinforcement, 154 pounds per cubic foot.

(2) Live load, 75 pounds per square foot upon slab; 50 pounds per square foot in figuring beam and girder forms and struts.

(3) For allowable compression in struts use 600 to 1,200 pounds per square inch, varying with the ratio of the size of the strut to its length. (See table below.) If timber beams are calculated for strength, use 750 pounds per square inch extreme transverse fiber stress.

(4) Compute plank joists and timber beams by the following formula, allowing a maximum deflection of 1/8-inch.

$$d = \frac{3}{384} \frac{W l^3}{E I} \quad (1)$$

$$\text{and } I = \frac{b h^3}{12} \quad (2)$$

in which

d=Greatest deflection in inches.

W=Total load on plank or joist.

l=Distance between supports in inches.

E=Modulus of elasticity of lumber used.

I=Moment of inertia of cross-section of plank or joist.

b=Breadth of lumber.

h=Depth of lumber.

The formula is the ordinary formula for calculating deflection except that the coefficient is taken as an approximate mean between 1-384 for a beam with fixed ends and 5-384 for a beam with ends simply supported.

For spruce lumber and other woods commonly used in form construction, E may be assumed as 1,300,000 pounds per square inch.

Formula (1) may be solved for I, from which the size of joist required may be readily estimated.

The given weight of concrete per cubic foot is somewhat higher than is frequently used, but is none too much where a dense mixture and an ordinary percentage of steel is used. For very rough calculation, however, it is frequently convenient to remember that 144 pounds per cubic foot is equivalent to the product of the dimensions of a beam in inches times a length of one foot.

The suggested live load, 50-75, is assumed to include the weight of men and barrows filled with concrete and structural material which may be piled upon the floor, not including, however, the weight of piles of cement or sand or stone,

*Engineering News, December 20, 1906, 1906, p. 648.

*Engineering News, December 20, 1906, 1906, p. 646.

which should never be allowed upon a floor unless it is supported by concrete sufficiently strong to bear the weight, or by struts under all the floors below.

The units for stress in struts are somewhat higher than in timber construction because the load is a temporary one. The extreme variation given is due to the fact that when a column or strut is longer than about 1 times its smallest width there is a tendency to bend which must be prevented either by bracing it both ways or allowing a smaller load per square inch. For struts ordinarily used the following stresses may be assumed for different heights:

Length of Strut, Feet.	Safe Strength of Wood Struts in Forms for Floor Construction. Pounds per sq. in. of cross-section.			
	Dimension of Strut.			
	3x4-in.	4x4 in.	6x6 in.	8x8 in.
14		700	900	1100
12	600	800	1000	1200
10	700	900	1100	1200
8	850	1050	1200	1200
6	1000	1200	1200	1200

Bracing both ways will of course reduce the length of a long strut.

If the concrete floor is comparatively green, the load must be distributed by blocking, preferably of hard wood. At the top of the strut provision must be made against crushing of the wood of the plank or cross-piece. Ordinary soft wood will stand, without crushing, only about 700 pounds per square inch across the grain, so if the compression approaches this figure, brackets must be inserted or hard-wood cleats used.

The best contractors have definite rules for the minimum time which the forms must be left in ordinary weather, and then these times are lengthened for changes in conditions according to the judgment of the foreman.

Correspondence with a number of prominent contractors in various parts of the country, including The Aberthaw Construction Company, Boston; The Expanded Metal & Corrugated Bar Company, St. Louis; The Ferro-Concrete Construction Company, Cincinnati; The Trussed Concrete Steel Company, Detroit; and The Turner Construction Company, New York, indicate substantial agreement in the minimum time to leave forms. As a guide to practice, the following rules are suggested, these following in the main the requirements of the Aberthaw Construction Company.

Walls in mass work: one to three days, or until the concrete will bear pressure of the thumb without indentation.

Thin walls: in summer, two days; in cold weather, five days.

Slabs up to 6 feet span in summer, six days; in cold weather, two weeks.

Beams and girders and long span slabs: in summer, 10 days or two weeks; in cold weather, three weeks to one month. If shores are left without disturbing them, the time of removal of the sheeting in summer may be reduced to one week.

Column forms: in summer, two days; in cold weather, four days, provided girders are shored to prevent appreciable weight reaching columns.

Conduits: two or three days, provided there is not a heavy fill upon them.

Arches: of small size, one week; for large arches with heavy dead load, one month.

Mr. Warm, president of the Aberthaw Company, states five years.

All of these times are of course simply approximate, the exact time varying with the temperature and moisture of the air, and the character of the construction. Even in summer during a damp cloudy period, wall forms sometimes cannot be removed inside of five days with other members in proportion. Occasionally too, batches of concrete will set abnormally slow either because of slow setting cement or impurities in the sand, and the foreman and inspector must watch very carefully to see that the forms are not removed too soon. Trial with a pick may assist in reaching a decision.

Beams and arches of long span must be supported for a longer time than short spans because the dead load is proportionately large, and therefore the compression in the concrete is large even before the live load comes upon it.

The general uncertainty and the personal element which enters into this item emphasize the necessity for some more definite plan for insuring safety. The suggestion has been made that two or three times a day a sample of concrete be taken from the mixer and allowed to set on the ground under the same conditions as the construction until the date when the forms should be moved. These sample specimens may be then put in a testing machine to determine whether the actual strength of the concrete is sufficient to carry the dead and construction loads. Even this plan does not provide for the possibility of an occasional poor batch of concrete, so that watchfulness and good judgment must also be exercised.

REPORT OF COMMITTEE ON FIRE-PROOFING AND INSURANCE.

The past year has witnessed some interesting progress in the development of fire resistive qualities of concrete. In the hollow block line there have been no actual fires of importance in buildings of this construction, so far as your committee have learned, but several tests have been conducted by various parties, all of which tend to confirm the views expressed in last year's report to the effect that concrete, properly made and applied, is an excellent fire resistive material for certain uses, but has limitations which preclude its being properly classed as absolutely "fireproof." Tests such as have recently been reported in the press by Mr. Somerville, of the Washington building department, and others demonstrate beyond doubt that hollow blocks will surely break apart from unequal expansion of the different sides if subjected to a very serious fire and therefore such blocks are not suitable for "fire walls" or for any part of a building which by reason of its size or contents may develop a fire of high temperature or, particularly, of long duration.

Other experiments involving fire of shorter periods or lower temperature have not developed this weakness and indicate that under conditions of comparatively mild exposure hollow blocks may be reasonably safe. Just how much fire they will stand in point of temperature and time is yet to be determined and we anticipate will be ascertained in the tests now in progress by the Government laboratory under Mr. Humphrey and the Underwriters' laboratories at Chicago. We shall be disappointed if considerable of this data is not produced during the current year.

In the field of reinforced concrete the conflagration at San Francisco furnished numerous examples of very good results in concrete floors. There were thirty-one buildings involved in the fire, having more or less concrete, almost all in the shape of floors, of which those of good design and workmanship (according to generally accepted standards) came through with little structural damage. Aside from this San Francisco experience the year has brought little in the way of actual demonstrations of fire resistance of reinforced concrete, and anything further on the subject would necessarily be repetition of our report of a year ago.

Insurance companies are still tak-

ing an active interest in the investigation of this subject through various committees; they are endeavoring to rate all buildings on their merits and are doubtless progressing as rapidly as the state of the concrete building art will permit. As the use of concrete in all forms increases and experience of engineers and builders improves the quality of work, we believe underwriters will be found ready and anxious to recognize liberally all the progress shown, though for the present it is only reasonable that they should be conservative in their ratings on account of the defects in design, material and workmanship which have been so common in the art up to this time.

We would again suggest the importance of members reporting to this committee all cases of fire in buildings of concrete construction of any type. This field experience is most valuable in solving the various questions involved in fireproof qualities of concrete and we respectfully urge that all members bear this committee's work in mind and see that full details of fires are reported.

Respectfully submitted,

Edward T. Cairns,
Chairman.

MEDUSA WATERPROOFING.

R. R. Fish.

There are many methods in use for obtaining waterproofed results in concrete work, even though some of the methods give questionable but temporary results.

There are, for example, a great number of washes on the market which are sold under the head of waterproof compound, but we all know that even the best white lead paint exposed to the weather eventually has to be replaced, therefore I have no faith in waterproofing compounds applied in the shape of a wash. There is one other serious objection to a waterproofing wash, which is, that the color of concrete work generally suffers from its use and the company I represent has on file letters to the effect that out of five or six different waterproof washes tried by responsible parties, none of these gave satisfactory results.

There is also the methods of waterproofing with paper, tar, asphalt, pitch, etc., and in work done under these systems it frequently happens that where the paper laps, leaks are found, and where pitch and asphalt and tar is used the concrete mass is separated and the strength of a floor or wall constructed of concrete is therefore impaired; for example, in

waterproofing a concrete cement floor in a building asphalt is sometimes used between the bottom course and the finishing coat. This prevents the finishing coat from adhering to the bottom course and with heavy use, in time, such a finishing coat is liable to separate and break.

Mr. S. B. Newberry, who is unquestionably acknowledged as an authority on cement chemistry and the uses of cement, has made an exhaustive study of waterproofing concrete work and has arrived at the conclusion that the material used for waterproofing concrete must be a substance which in no way affects the strength, color or setting qualities of cement; at the same time it must be a substance which is embodied in the concrete mass.

There is considerable talk in the cement journals of elastic waterproof compound and some engineering papers even go so far as to say that concrete work can not be waterproofed until an elastic waterproofing material can be discovered; that is, one which will contract and expand with the concrete work, in order that no cracks occur that would permit the passage of water.

The material which I have here and which I intend to demonstrate to you does not absolutely fill the voids of concrete, nor is it necessary to fill the voids of concrete to make it resist water. The material here resists water sufficiently so that with the use of one to two per cent of the weight of cement employed, reservoirs, cellar floors, walls, concrete blocks and all classes of concrete construction can be made absolutely waterproof.

Some of the cement journals have recommended the use of soap and alum as a waterproof solution, and in regard to this would say that I recently superintended the waterproofing of the Herbivora building for the Cincinnati Zoological Company, at Cincinnati, Ohio. That building was constructed of reinforced concrete and the roofs of the building had received a treatment of soap and alum mixture. This did not give satisfactory results and the building leaked in every section.

The trustees of the building decided to sheath the roof with copper at a great expense and the company which I represent, and which manufactures this waterproof compound I have here on exhibition, induced the board of directors for the Zoological Company to apply a cement mortar coat to the exterior of

their building, this mortar coat to contain a 2 per cent mixture of this waterproof compound. I take pleasure in reading a letter recently received from the chairman of the committee on buildings and grounds, Mr. Taylor, which shows the results obtained in the use of this material:

"The resurfacing of our new Herbivora building with your Medusa compound was completed early in this month and included all five of the domes and supporting walls above the first story. The work has been in progress since October and has been slow and difficult, owing to the very complicated character of the roof surfaces, but the delay has enabled us to test it both with heavy rain storms and melting snow. The result is perfectly satisfactory under these conditions and there is not a sign of leak in any part of the roof or walls.

When we applied to you last September, these roofs, laid with concrete after the ordinary method, were leaking in every section and we were facing the problem of leaving the animals in their old winter quarters and were seriously considering the great expense of a complete metal roof next spring. Our committee was more than skeptical of its success with concrete in any form, and I confess that we undertook the responsibility of trying your compound with great reluctance. The result so far is all that we could desire, and if the roof does equally well under conditions of extreme heat and cold hereafter, we can ask nothing better.

I wish to thank you for the many courtesies shown us by yourselves and representatives. You have certainly spared no pains to accommodate us in every way."

Going back to the subject of an elastic waterproofing material, would say that if concrete can be waterproofed at all, there is no material that can be added which will find its way to any serious cracks that appear in concrete structures or any material that can be used in any way to remedy such cracks, unless such cracks might be corrected by being filled with a cement mortar containing waterproofing material. There is hardly any danger of serious cracks occurring in any concrete work, and therefore, if the concrete is put in properly under a good superintendent and in proper proportions this waterproof compound, if used correctly, mixed dry with cement before sand and water is added, will secure for the engineer a perfect waterproof job.

Probably the most wonderful accomplishment in the waterproofing line of late has been the waterproofing of a shot tower by the Equitable Powder Manufacturing Company at Alton, Ill. I quote from the letters received from Mr. Wagner, the engineer on that work:

"The writer had some correspondence with your company last spring in the name of the Equitable Powder Manufacturing Company about 'Medusa' waterproofing compound. The sample submitted by you for testing proved satisfactory and we purchased 500 pounds from the Alton Roofing & Artificial Stone Company, who were having a car shipped them at that time.

Our work of sinking an 80-foot well, 10 feet in diameter, for a shot tower, has proved a very interesting problem from an engineering standpoint.

A very bad bed of quicksand was met with, and deeper down a great deal of coarse sand and gravel.

The flow of water, which had to be kept out by pumping during the digging, varied from 2,000 to 30,000 gallons per hour.

The concreting of this well has proved successful beyond our utmost expectations. We had hoped for but a small seepage, but with the use of Medusa waterproofing the walls at the bottom under pressure on the outside of 60-foot head of water have dried out and show as white and dry as above the surface of the ground."

Letter No. 2

"In answer to your inquiry of the 27th, I beg to advise that the concrete in question was mixed in the proportion of 1, 2 and 4. The sand was clean, coarse river sand, and the stone, crushed limestone, passed through a 1-inch screen, but held up by a quarter-inch screen. For water pressure of more than 25-foot head I used six pounds of 'Medusa' waterproof compound to one barrel of cement and reduced this amount gradually to three pounds as the pressure decreased.

"I did not try to stop the leaks, thereby creating a pressure, but combined them at several points and led them through the concrete in iron pipes. The leaks were allowed to run for four weeks and the concrete being then set hard enough to withstand the pressure, the pipes were closed, shutting off all leakage and putting total pressure on back of the wall. In spite of this water pressure the wall dried out perfectly white.

"I will be glad to answer any fur-

ther inquiries you may wish to make, but hope before long to place before you a complete description of this work."

Any question that any of the members present wish to ask in regard to waterproofing, I will be very glad to answer if I am able, and anyone sufficiently interested in obtaining waterproof results to care to experiment with the material that I have here, will be able to satisfy himself that it is the only dry substance on the market that will absolutely do all that is claimed for it and that will give permanent and perfect results as well as in no way affect the strength or color of concrete.

CEMENT SIDEWALK PAVING.

By Albert Moyer, Assoc. Am. Soc. C. E.
M. Natl. Cement Users' Ass'n.

Cement sidewalk paving is a manufacturing industry, whereby cement stone slabs are framed in place on the job. Paving of this description has various uses. Its principal use is a permanent path for pedestrians. Among the other uses are drive-ways for vehicles, a floor wearing surface for buildings, platforms in the stations of transportation lines, wharf coverings, cellar floors, curb and gutters. The principal object to be accomplished in manufacturing these cement stone slabs for the above named purposes are permanency, durability and neatness.

Its Permanency.—To accomplish permanency it is necessary that these slabs remain hard, tough and in the original position for the average life of good construction work. To accomplish this object, correct methods of manufacture must be employed, which will avoid settlement cracks, upheaval by frost and roots of trees, crumbling due to work having been laid in freezing water, contraction cracks, expansion cracks, separation of top from base and disintegration.

Settlement Cracks.—To avoid settlement cracks it is necessary to thoroughly ram the ground after excavating for foundation. After drainage foundation has been put in place this should be thoroughly and evenly tamped so as to avoid uneven strain. The thickness of the slab should be governed by the factor of safety necessary to provide for the weight that is likely to be placed on any one slab. It is estimated that a number of persons can be so crowded together as to cause a weight of from 100 to 150 pounds per square foot. As the strength of

the slab is not always governed by its thickness, it will be necessary to properly proportion the aggregates so that maximum density results.

Upheaval by Frost.—To avoid upheaval by frost, a proper drainage foundation must be provided, such foundation to be carried to a sufficient depth to get below the average frost line as may occur in the various localities; a drainage foundation is of use only in event that it thoroughly drains. Such a foundation is often placed so that it not only fails to accomplish the purpose for which it was intended, but practically defeats that object by causing an accumulation of water which in freezing upheaves the pavement. A drainage foundation should have an outlet which has a fall of about one-fourth inch or over to the foot. If there is no natural outlet for such drainage, blind drain leaders should be provided at points along the walk where they are necessary. These leaders should be formed of similar material as the drain itself, with possibly the addition of a porous drain tile leading into holes filled with cinders or crushed stone which will allow the surrounding earth to absorb the accumulated water.

Upheaval by Tree Roots.—This can very easily be avoided by cutting out any roots which will run under the pavement higher than a depth of 18 inches to 2 feet.

Contraction Cracks.—Portland cement concrete expands and contracts in practically the same ratio as steel; it is therefore necessary to cut joints which will allow for this expansion or contraction. The concrete must be cut entirely through with a cleaver, or other instrument from $\frac{1}{8}$ to $\frac{1}{4}$ inch wide, the blocks thus formed to not exceed 6 inches square. I am fully aware that very excellent work has been done, the blocks being as large as from 12 to 14 feet; that good results were obtained with such large slabs is due more to favorable circumstances than to correct method. By figuring the expansion and contraction per degree between the heat of summer and the cold of winter, it will be found that we are only within the region of safety when the slabs do not exceed 6 feet with an $\frac{1}{8}$ -inch joint between each slab.

Expansion Cracks.—Expansion cracks are not due so much to the expansion of the cement stone slabs as to the expansion of other material bearing against these slabs; it is therefore advisable to cut the concrete away from the manholes, iron posts, etc., leaving about the same

space in the joints as between the slabs themselves. This space may be readily waterproofed by using felt paper painted with a good waterproof paint.

Separation of Top From Base. — In the past it has been a very common practice to allow the base to set hard before laying the top coat; it is unnecessary at the present date to dwell on this subject; we all know that it is utterly wrong. There are, however, other causes which prevent the top coat from adhering permanently to the base, the principal cause being carelessness in allowing men to walk over the base carrying with them dust and dirt, also failure to protect the base, allowing the surface of the base to be exposed to the rays of the sun and thus dry the surface prematurely, at the same time allowing dust and dirt to blow over the surface, coating the concrete so that the top when placed fails to adhere permanently. It is also absolutely necessary that the top be cut directly over the cuts in the base; otherwise the top coat will crack along the line of least resistance. To obtain good and permanent results whereby the top coat becomes a permanent part of the base, one brand of cement should be used in the top and in the base; the difference in time of setting, the characteristics of one brand being different from another, will often cause a separation of top from base.

Disintegration. — The principal cause of disintegration is insufficient mixing, drying out before ultimate crystallization of cement and bad material used. Start right and good results naturally follow. To avoid disintegration material should be carefully selected. This selected material must be thoroughly incorporated and mixed in plastic mass with sufficient water to bring about ultimate crystallization of the cement. Being thus mixed it should be immediately placed, thoroughly and evenly tamped and then protected from drying out before final setting. Cement needs water, not only when mixed but after having been placed and tamped and it requires water until ultimate crystallization has taken place. If any portion of the concrete is robbed of the amount of water necessary to bring about this result, the concrete is weakened to that extent.

Selection of Material. — It is important that the best material be used in the manufacture of Portland cement sidewalks. Poor material makes poor walks and costs about as much money. For a very

strong concrete a hard stone without any surface scale is absolutely necessary. A rich mortar will not entirely counterbalance a deficiency in the strength of the stone. For a medium strong concrete, the hardest stone need not be insisted upon, but rather one to which the mortar will best adhere, such as some of the limestones. Stone breaking in cubical form is far better than one breaking in flat layers, such as shale or slate, it being almost impossible to ram or tamp such stone into such dense or compact a mass as that breaking in cubical fracture. The trend of the times is toward small stone. The writer advocates a concrete made of stone, all of which will pass through an inch mesh; and better still, all of which will pass through a three-quarter-inch mesh and so graded in size that as far as possible the voids of each progressive volume are filled with the largest particles that will fit them, graded from three-fourths inch down to fine dust. Thus a minimum of cement will give a stronger concrete in compression than could be obtained with a larger percentage of cement using the same quality of sand and stone, but not so well graded in size. A strong concrete can be made without the use of sand. Instead of sand, use screenings or quarry tailings made from only the hardest and toughest stone. These screenings are usually graded in size, each particle furnishes a better anchorage for the cement, greater density results, better adhesion and a stronger concrete than can be obtained by even the best of sands. Gravel is often superior to broken stone and sand, being generally found graded from coarse to fine; the roundness of the pebbles lends aid to compactness. Keep in mind that density is the object to be obtained. Maximum density is maximum strength under compression. Gravel is not likely to bridge and leave holes in the concrete. The coarse pebbles are harder, stronger and less liable to fracture. In discussing gravel versus broken stone, I am considering a concrete made of gravel and sand versus concrete made of crushed stone and sand, and in this discussion quartz pebbles, or rather very hard pebbles, are referred to. Sandstone pebbles are not considered as good as the better grades of crushed stone. The usual argument against gravel is that the mortar is not supposed to adhere as well to the surface as to that of fresh-broken stone. This is one of the theories which is prac-

tically due to the appearance of the surface to the eye or touch; the adhesion of mortar to limestone of a smooth surface may be far greater than to sandstone or rougher materials. If roughness was the only requirement for adhesion, it would seem impossible to cement together two pieces of glass. And from the standpoint of durability, gravel must be superior to stone for the reason that by the law of the survival of the fittest and by process of elimination, nature has supplied us with the most durable. In selecting sand, the value of sand for concrete mortar depends largely on its coarseness and graduation in size of the grains. Avoid the use of fine sand. It makes a concrete which resembles pumice or punk. The reasons for this are well known. This is a subject which would require too long a time to discuss in this paper. The sharpness of the grain of sand has little to do with its value. It has commonly been supposed that sand should be sharp. The writer is rather in favor of a very coarse, round-grained sand. Compactness is what is desired and round grain will give greater density to the mortar than sharp grain, and cement will cling to the surface of round grain as well as sharp, the character of the surface being identical. Sharp sand as an indication of value is only useful in that it denotes a silicious sand. The best sand is that which when mixed with cement and water in the required proportions by weight produces the least volume of mortar. The method of determining the best sands to use for the purposes of economy is another subject which is too lengthy to discuss in this paper.

In selecting Portland cement, it is best to specify the requirements of the "Standard Specifications" as adopted by the American Society of Civil Engineers, and select for purchase that brand which is produced by manufacturers of experience and reputation, as ascertained from a number of well-known engineers, their experience extending over a period of at least five years. The selection of Portland cement is largely that of reputation, the manufacturer having made a reputation by producing a uniformly excellent article cannot afford to sacrifice that reputation; a brand of long and good reputation having been purchased, the specifications and test of the American Society of Civil Engineers can be held as a check against errors or mistakes in manufacture. This method of selecting Portland cement always gives the

user the best material obtainable at the fairest price—not the lowest price—making it to the advantage of the manufacturer to produce for the user's interest, also offering an incentive to the manufacturer to produce the best product at all times, making improvements as science advances.

Mixing.—Having selected the best materials obtainable, by far the most important operation is that of mixing. The methods employed in mixing by hand as well as by machinery, depend largely upon the character of the aggregates used. It is now being almost universally recognized that the small aggregates make the densest, strongest and best concrete. As a sample, in mixing a concrete made of three-fourths-inch hard limestone or traprock and good coarse sand, the cement and sand should be dry mixed, the best method is by use of shovels and a garden rake, each shovel full as turned should be thoroughly raked; dry three-fourths-inch stone is then added and the process repeated; the mass should then be formed into a crater, a sufficient amount of water added, then turned with a shovel and raked as before. By this method it will be found that a more perfect incorporation of all the aggregates results than if the mass had not been raked, but had been turned another time with the shovels; the raking takes the place of one turning, but does it better. A perfectly mixed concrete results if the shoveling raking is properly performed. Another method is wet the mortar before the stone is added, proceed as before. I have found that if quarry screenings or tailings are used for the mortar it is better to mix all the aggregates dry; that is, first the cement and screenings; then add the three-fourths-inch mass to the desired consistency, raking during each stage of the process as previously described; this for the reason that if the stone is added to a wet-mixed mortar, the mortar will work up into balls and lumps which are hard to break up, and which causes an uneven concrete; too much mortar in one place and too little in another. This same principle can be carried out in machine mixing for the smaller aggregates. Machine mixing should be accomplished much the same as it is in Germany, the mortar mixed dry, then the stone added, then the whole mass mixed dry; this entire mass is then run into another mixer and there mixed wet. This result can be fairly well accomplished by

using a mixer which has knives and rakes, which does the same thing as turning and raking in the hand-mixed process.

Placing and Tamping.—The concrete should not be made so wet that it will quake under the tamping iron, unless steel strips are used for the joints or laid in alternate block; it should be sufficiently wet, however, so that some moisture arises to the surface under the tamping. The proportion of water necessary will vary according to the climatic and other surrounding conditions. The proper consistency can only be judged by the eye on the mixing board; no accurate specifications can possibly bring about uniform and desirable results. This is a matter which necessarily has to be left to experience. The tamping should be vigorous and uniform.

Drying Out.—One of the causes of bad workmanship is due to the concrete either in the top or the base having prematurely dried. This is avoided by keeping the concrete covered to protect it from the rays of the sun. If the concrete is anywhere near boilers or steam pipes; see to it that the concrete is wet continuously for from twenty-four to thirty-six hours; after this period sprinkle two or three times a day for a couple of weeks, or such length of additional time as economy will permit. Sidewalk paving slabs are acted on from both sides and being thin comparatively are more sensitive than mass concrete, therefore need greater protection. The writer has seen instances where workmanship as far as selection of materials, mixing, placing and tamping were thorough and excellent, but, nevertheless, bad results were obtained. This was particularly true of a pavement laid over waterproofing. The atmosphere absorbed the moisture from the top and the top absorbed the moisture from the base. The base had nothing wet under it from which to get water, could not supply sufficient moisture to the top to offset the action of the dry air, the result was a top of chalky consistency. Had the foundation been made very wet and the top covered with wet sand no such results would have been produced.

Durability.—Durability relates principally to the wearing surface; there is no reason why a cement slab should not wear longer than the ordinary natural stones; for in forming these slabs we have the advantage of selecting the toughest and strongest stones. Cement, itself, is tougher and stronger than

most of the products of nature. The texture of the surface has a good deal to do with efficiency. A scum or skin of neat cement on the surface soon wears through causing an ugly and blotchy pavement. There is no reason why a slab of cement stone cannot be manufactured which would wear for a hundred or more years; it might wear down to the extent of half an inch, or an inch or more, and still preserve the same texture. This is perfectly feasible by making a slab of one piece, no top coat whatever, an even smooth top, carefully jointed, composed of small selected aggregates and in proportions which result in maximum density. I have seen one or two pavements of this character, notably the one around the Hotel Astor, New York, which is in 9 inch slabs, entirely around the building, expansion joints cut at regular intervals and so arranged as to form an architectural design. The concrete was composed of $\frac{3}{4}$ -inch traprock and sand. The surface was floated off and smoothed down with a trowel; it was not troweled to such an extent as to bring any neat cement to the surface. This pavement will wear for two hundred years or more, and as it wears down the same texture is preserved. The usual troweled surface is slippery, it does not wear, is subject to all manner of diseases, such as hair-cracks, crazing, peeling, etc., and is only beautiful before the disease sets in. A monolithic leveled off and smoothed to an even surface in which flint or quartz pebbles show through, such as some of our granolithic sidewalks, can be thoroughly tamped and then floated so that the above desirable results are economically obtained. Another method is to use $\frac{3}{4}$ -inch hard stone, quarry screenings or sand, making one slab at one time straight edge off, tamp uniformly, smooth down to an even surface with float and trowel, cut joints, carefully mark joints with a good jointer, round the edges, and after final set is reached, but before the surface has begun to dry, scrub with a steel brush such as is used in cleaning boilers; play a hose on the surface just ahead of the brush and scrub the surface vigorously. This removes the neat cement from the exposed surfaces of all the aggregates, does not disturb the aggregates, and gives a most beautiful, natural and genuine finish, similar to natural granite, you therefore have a pavement which is honest and genuine clear through and is obviously so.

Neatness.— Neatness is obtained by the texture produced as described above, by carefully marking the joints and rounding the edges. Be careful not to use too much water so that an excess water rises to the top, carrying with it particles of neat cement. This causes hair-cracks, crazing, streaks and efflorescence. Another disease is occasioned by an accumulation of water in any one or more places which will cause what has been commonly known as water-cracks, which are not open cracks but surface cracks, which look like dark blotches. In discussing this subject of neatness, observation would indicate that the thought uppermost in the mind of most sidewalk paving contractors has been that of forming an artificial top of veneer over the rougher concrete. Do not use lamp black, it is the worst form of poor imitation. Sidewalk paving construction, like all other forms of engineering, is only permanently and lastingly good if honest and genuine. I will sum up these suggestions by endeavoring to frame a set of specifications, leaving out as much detail as possible, so that they may possibly be standardized, useful, and, I trust, universal.

CEMENT SIDE WALK SPECIFICATIONS.

Sidewalks in cold climates where frost occurs, should consist of a foundation of coarse cinder, broken stone, brick bats, or other porous material, extending below frost line, the concrete to be laid on this foundation. Do not lay concrete in freezing weather.

Drainage Foundation.— Excavate to a sufficient depth so as to get below the frost line, ram and tamp the ground thoroughly and evenly, fill in with clean cinders, broken stone, or brick bats, to within . . . inches of top of the established grade of the pavement (a sufficient number of inches to provide for the thickness of slab necessary to give sufficient strength for the character of the work it is to perform); tamp this drainage foundation well and evenly, thoroughly wet the cinders, stone or broken brick, place in position wooden forms in a manner necessary to accurately outline the top and external edges of the walk, the top of the form being located so as to coincide with the established grade of the walk. As an additional precaution, and where

necessary to accomplish the purposes of drainage, side drains should be placed every 10 or 12 feet, having a fall of not less than $\frac{1}{4}$ inch to the foot, leading to some point forming an outlet for water which may accumulate. This outlet should be below the frost line and may be accomplished by a hole filled with cinders, stone, or brick bats.

Concrete Base.— For a concrete base, spread . . . inches, number necessary to provide for the thickness of slab which will come to within 1 inch of the top of the established grade; this concrete to be composed of one part Portland cement and two and a half parts sand or quarry screenings, all passing $\frac{1}{4}$ inch mesh, and five parts broken stone or gravel, all passing 1 inch mesh.

These specifications may be regulated if proportions can be obtained which will allow of a larger proportion of broken stone, at the same time giving maximum density. Tamp the concrete to an even thickness, cut same into uniform squares of not over 6 feet square, using a steel cleaver of not less than $\frac{1}{8}$ inch and not over $\frac{1}{4}$ inch in diameter. Fill the joints thus formed with dry sand so that there is no possibility of the square blocks adhering together. Mark on the wooden forms the exact locations of these cuts. After each batch of concrete is laid as required, it shall be immediately covered with a top coat, or wearing surface, no dirt or dust having been allowed to accumulate on the base and the surface of the base to be wet or moist. Any portion of the foundation which has been left long enough to have the appearance of setting or hardening shall be taken up and relaid before the top coat is put on. Another method of separating the blocks is as follows:

C.—Wooden strips 2x3 inch lumber (movable).

D.—Long wooden strips 2x3 inch lumber (movable).

F.—Wooden frames 2x4 inch lumber, top of which coincide with established grade of walk.

S.—Stakes for holding frame in position.

Place a 2x3 inch strip (see diagram, letter D) parallel with sides of walk, in such position as will form square blocks, or equal dimensions, not over 6 feet wide; brace same with stakes but do not nail to frame, then cut a strip 2x3 inches, the length of which is to be the width of the blocks, or distance between strip D and side frame F. Place this strip so as to form a square

block (see diagram, letter C). On inside of strips C and D place thick tar or felt paper $\frac{1}{4}$ inch thick and 3 inches wide; fill in the space thus formed (block A) with concrete composed of one part Portland cement, two and one-half parts sand and five parts crushed stone or gravel, mixed thoroughly. Tamp concrete thoroughly to an even thickness of 3 inches, then remove strip C; the tar paper will adhere to the concrete. Move strip C to the next position (see diagram dotted lines block B), place the thick tar or felt paper as before, and proceed the same with each block, laying alternately. Put on to coat before the first block made starts to set or harden, and in regular order as blocks were made.

Top Surface.— For wearing surface, mix one part Portland cement with two parts crushed granite or other hard stone, all of which will pass through a quarter-inch mesh screen, or good coarse sand; mix by turning with shovels, raking with a garden rake as each shovel full is turned, turn twice dry and twice wet; add sufficient water to make a plastic consistency so that when floated or troweled very little water rises to the surface. Spread this mortar over concrete base to a thickness of one inch. Work to a flat surface with a straight edge, smooth down with float and trowel after surface water has been absorbed; be careful to get an even surface, bringing no neat cement to the surface and avoiding float and trowel marks.

Cut top surface directly over cuts made in base; cut entirely through top and base all around each block. Finish joint thus made with a jointer and round or bevel all edges.

Monolithic Slab.— As an alternative, and instead of using a top coat, make one slab of selected aggregates for base and wearing surface, filling in between frames concrete flush with established grade. Concrete to be of selected aggregates, all of which will pass through a three-fourths-inch mesh sieve, hard, though stones or pebbles graded in size, proportioned to be one part cement, two and one-half parts crushed hard stone screenings or coarse sand, all passing a one-fourth-inch mesh, and five parts crushed hard stone or pebbles, all passing through a three-fourths-inch mesh. Tamped to an even surface, prove surface with straight edge, smooth down with float or trowel, and, in addition, a natural finish can be obtained by scrubbing

with a wire brush while concrete is "green," but after final set.

Expansion.—Do not allow any block to bear directly against any solid body, such as stone curb, building, post, manhole rim, etc. Leave the same space (about one-fourth inch) between pavements and such fixtures as is between the blocks themselves. This applies to the base and top as designed to avoid cracks and chipping due to expansion and contraction from temperature changes. This space can be conveniently provided for by the use of thick tar paper or felt, waterproofed with any of the reliable waterproof paints.

Protection and Seasoning.—Immediately as finished cover pavement so as to protect against rays of sun and drying, raising covering a few inches so as not to come in contact with the surfaces after pavement has reached hard set, sprinkle frequently, two or three times a day, with a garden hose or sprinkler for a week or more. Albert Moyer, Manager Sales, Vulcanite Portland Cement Co., Flatiron Bldg., New York.

January 2, 1907.

CEMENT BLOCK FOR TUNNEL LINING.

The New Zealand Government Railway extension will construct a tunnel 28,062 feet long. The cut will be 15 feet wide, 15 ft. 6 in. high above the rails. The specifications favor concrete blocks as will be seen from the following: The walls may be concrete 12 in. thick. Brick 14 in. Rubble masonry 16 in. thick. The concrete blocks for lining the arch will be 12 in. thick, 18 in. long and 9 in. wide on the soffit face bonded to break joints as in ashler masonry. For extra thickness, 18 ins. and over, two or more rings of blocks 9 ins. thick may be used. The blocks must be left in the molds for at least 24 hours, then laid out on platforms and finally stacked, being wetted at intervals. They must not be put into the work until at least 50 days old. The concrete is to be composed of Portland cement, sand and broken stone, 1 to 2 to 5; half of the stone must not exceed 1½ ins. and the remainder must be of smaller assorted sizes.

CONCRETE BUMPING POSTS.

The Lackawana Railroad has been experimenting with concrete bumping posts which are placed at

the end of spur or stub tracks to prevent cars from leaving the track when the brakes fail to act. The Lackawana post or bumping block is a bed, concrete carried under the end of the rails and is given a gradual rise and terminates on a mass of concrete, with a granite block projecting from the concrete to receive the thrust of the car bumper. The device has proven so successful that concrete bumping blocks will be installed in all of the yards of the company's system.

The Chicago & Rock Island Pacific Railway has several concrete bumping posts in use at its yards near 43d street, Chicago, consisting of a mass of concrete nearly 10 feet long, 4½ feet wide and 9 feet deep, projecting 5 feet above ground. The track extends or overlap the sides of the block, the rails are bent upward to receive the car when it strikes the block. The blow, is received at the end of the block which has a face of 4 in. plank, each plank being held by two bolts anchored in the concrete. An iron plate at the height of the bumper on the car, distributes the blow over the face of the concrete block, the wood acting as a cushion between the block and the iron plate.

CEMENT POST CATALOGS AND INFORMATION WANTED.

The addresses of manufacturers and users of cement posts are wanted, together with catalogs and printed matter describing cement posts for the purpose of compiling data on the subject, which is to be published in the Iowa Highway commissioners report. Send all communications on this subject to Able O. Anderson, Lake City, Iowa.

INCORPORATIONS.

Joplin Cement Co., of Joplin, Mo., capital \$6,000, one-half paid. Incorporators—William B. Meyers, Ardi McDonald, Chas. McDonald and A. G. McDonald.

Perfection Cement & Cement Co., Abilene, Taylor Co., Texas; capital \$5,000.

The Faxon Cement Block Building Company of Faxon, Okla., capital stock \$50,000. The incorporators are: Jacob F. Piercy and Charles L. Thornton of Faxon, John W. Bartholomew of Lawton.

The Builders' Cement Company, Cleveland, Ohio; W. E. Patterson, J. W. Burrell, J. Paul Thompson, E. R. Smunt, M. E. Faig; capital, \$10,000.

The Gabriel Process Reinforcement Co., Detroit, Mich., has filed articles of association for the construction of reinforced concrete in all states with the exception of Michigan and those immediately adjacent. The capital is \$75,000, represented by patents. Carl E. Schmidt, as trustee, holds 5,635 shares, William Gabriel, 1,000, and the other 860 are divided among four others.

Reliable Cement Construction Co., Trenton, N. J., incorporated to manufacture Portland and other cements, building materials, etc.; capital, \$50,000. Incorporators, C. L. Wilson, D. S. Kennedy, E. L. Kem, all of Trenton.

Tompkins Bros., 74 Passaic St., Newark, N. J., to manufacture limes, cements, plasters, building materials; capital, \$250,000. Incorporators: Geo. W. Tompkins, Ambrose Tompkins, Brenton Tompkins, Newark.

The Century Concrete Company of Cleveland, Ohio; capital, \$15,000. Incorporators: S. T. Kernish, Geo. W. Spooner, L. S. Stuart, W. S. Kernish and G. E. Hartshorn.

Haskell Cement & Block Co., Brooklyn, N. Y., to manufacture lime, brick, etc.; capital, \$6,500. Incorporators: Simon Haskell, No. 230 Belmont Avenue, Brooklyn; Adolph Weinhandler and Selig R. Getlar, No. 40 East Ninth Street, New York.

Vancouver Portland Cement Co., Ottawa, Ont., with a proposed capital of \$1,500,000, and headquarters at Toronto, has been incorporated.

Meridith Construction Co., of Terre Haute, Ind., has incorporated to do general construction and concrete work; Paul J. Meridith, president.

The following is a list of officers of the Commercial cement Co., Ltd. President—W. P. Alsip, Winnipeg.

Vice President—Sidney Clarke, Grand Forks.

Secretary-Treasurer and Manager—Otto Babcock, Grand Forks.

Mr. Alsip was formerly a resident of Grand Forks, N. Dak., and besides the above, there are the following stock holders: K. J. Farup, C. D. Lord and George Towle, Park River; J. D. Bell, Arthur Dinnie, Mrs. W. D. Wood and Geo. B. Clifford of Grand Forks.

They have already let the contract for the machinery, and it is expected that it will reach there about

the first of the year. The buildings are now being constructed and the plant completed, will cost about \$25,000.—Grand Forks Times.

The company will erect a plant 70 miles northeast of Winnipeg, Manitoba. The cement will be known as the C. C. C. Brand. Contracts for most of the machinery has been closed. The plant will cost about \$25,000.

The Iola Portland Cement Co. recently shipped in a single car 1,140 bags of cement, consigned to the U. S. government for irrigation works in the west.

P. W. Stanhope of Chicago, who has the contract for financing and constructing a Portland cement plant at Rapid City, S. D., expects to commence construction work in the spring. Shale, limestone and gypsum are found on the company's building site. The plant is to cost from \$650,000 to \$700,000.

The West Coast Portland Cement Company has been incorporated at Seattle, Washington. This will be one of the largest producers of Portland cement in the world and will develop extensive cement

NOTICE.

At the Cement Users' Convention recently held in Chicago, the exhibition of the Century Cement Machine Co., Rochester, N. Y., was a leading feature. Over one hundred blocks of different sizes and designs all made on the wonderful Hercules Machine were built into two walls, front and back of the allotted space.

The exhibition also showed many designs of coping and ornamental work, and the entire exhibit was the center of an admiring throng during the entire convention.

A sign stretched above the entire length of the back wall advised visitors to:

Listen to what the others are going to do

Then see what the Hercules has done.

The demonstration of the Hercules which was freely given to all interested, clearly proved that it is a wonderful machine from every point of view. The strength of the Hercules is in keeping with its name, while the simplicity of mechanism and operation astonished the lookers on. Extraordinary interest was created when the operators in record breaking time pro-

duced two blocks of different size and design on the one machine at the one time.

The Hercules is a face down machine. Tamping is done directly on the face, thus insuring a clear, sharp impression.

Besides a large domestic trade, the makers of the Hercules are going after the foreign business in their usual aggressive manner, and have machines now in operation in nearly every civilized country in the world.

The company report a strong demand for their machinery and are prepared to meet all orders for their 1907 designs.

CHAS. A. MATCHAM

Leaves the Lehigh Portland Cement.

Charles A. Matcham, general manager of the Lehigh Portland Cement Company, tendered his resignation to that company on Saturday, to take effect February 1, 1907.

It is Mr. Matcham's intention of taking a rest for a few months after which he expects to organize a new cement company and build new plants.

Mr. Matcham is considered the best cement expert in the country. He was formerly connected with the Alpha Cement Co., at Phillipsburg, N. J., and in 1897 with Col. H. C. Trexler organized the Lehigh Portland Cement Co., which has been the most successful company in the country.

Mr. Matcham has built during the nine and a half years he has been with this company nine cement works in different parts of the United States and has now under construction two additional mills, one at New Castle, Pa., and one at Bellville, Canada. The output of the Lehigh company has increased from 800 barrels per day in 1898 to 15,000 barrels per day in 1907.

Mr. Matcham is also a member of the Fuller Engineering Co. manufacturers of cement machinery and recently incorporated.

The resignation came as a great surprise in local business circles. No predictions are made as to his successor.

ASBESTOS.

One of nature's most wonderful products is Asbestos, a material, which, in spite of its extensive use is comparatively unknown to the general public. Prior to 1850, it was looked upon principally as a cur-

iosity, although Charlemagne (Roman Emperor from 800 to 814 A. D.) is said to have had a table cloth made of Asbestos, which he cleaned by throwing into fire.

There are two varieties of commercial asbestos, known as Amphibole and Chrysotile. The former is used only to a comparatively small extent, as the fibres are short and without tensile strength and are, therefore, not suitable for manufacturing many of the asbestos products. Amphibole is used to some extent in cements, but is not well adapted even for that purpose. Chrysotile, on the other hand, has a strong and silky fibre, which adapts it for such materials as asbestos fabrics, household utensils, theater curtains, clothing for firemen, etc.

Asbestos is mined in open pits, similar to stone quarries, and although it is found in all parts of the world, the mines in Quebec, Canada, are the most famous, yielding about 85 per cent of the world's supply of chrysotile. Probably the largest of these mines is owned by the H. W. Johns-Manville Co. of New York. In 1879 the output of the Quebec mines was 300 tons, which has steadily increased year by year to 50,000 tons in 1907.

BOOK NOTICE.

Electrical Mining & Construction Tables, by Henry C. Horsbrunn and Victor H. Tousley. 118 pages: 5 $\frac{3}{4}$ x 4 $\frac{1}{4}$ in flexible leather binding. Price, \$1.50. Frederick J. Drake & Co., Publishers, Chicago.

An every day electric wireman's Pocket-Hand book. Contains tables for direct current calculations. Tables for alternating current calculations. These tables show at a glance the currents required with any of the systems in general use, for any voltage, efficiency, or power-factor, and by a very simple calculation (which can be mentally made) also the proper wire for any loss. Tables showing the smallest wire permissible with any system or number of H. P. or lights under "National Electrical Code" or Chicago rules. Very convenient for contractors. Tables for calculating the most economical loss. Tables and diagrams showing proper size of conduits to accommodate all necessary combinations or number of wires. Tables and data for estimating at a glance the quantity of material required in different lines of work.

TESTS OF BUILDING BLOCKS MADE AT LA-FAYETTE, INDIANA.

By Mr. R. D. Kneale, Instructor in Civil Engineering, Purdue University.

This paper is a description of the tests of some thirty plain concrete building blocks which were about one year old. These blocks were of the usual block type, 16x8x6 inches, with two 4x5 inch inside openings. All were made of the same materials and treated as nearly alike in manufacture as possible. The materials used were gravel 100 per cent fine on a sieve of one-half inch mesh, and Lehigh Portland cement. The proportions were 1 of cement to 5 of gravel. Each block was faced with 1:2 mortar, using the same cement as in the body of the block, and using an ungraded, clean river sand. The faces were so well bonded to the block that in no case did failure occur between facing and block. The faces were approximately one-half inch thick, and were not considered in figuring the cross section used in compression tests. After initial curing the blocks were stored outdoors without covering. They were selected at random for the test from large piles exhibited for sale.

Mr. B. K. Kramer, the manufacturer, states that with more skillful grading of materials he is able to secure much greater density.

The blocks were tested in the laboratory for testing materials at Purdue University. The results of the tests are as follows:

Six blocks were broken in flexure. Two 1-inch wrought iron rollers were placed 14 inches apart on the platform of a Riehle 200,000-pound vertical testing machine. On these rollers the block was placed, with the facing vertical. A third roller, 1 inch in diameter, was placed parallel to the others on the center line of the block, and the compression head brought down on this roller. The results given below show fair uniformity:

Flexure.

No.	Span.	Load at Failure. (lbs. per sq. in.)	Modulus of Rupture.
1	14 inches	6,040 lbs.	300
2	14 inches	5,270 lbs.	260
3	14 inches	4,900 lbs.	242
4	14 inches	3,900 lbs.	192
5	14 inches	4,300 lbs.	212
6	14 inches	4,880 lbs.	240
Average, 4,485 lbs.			241

Twenty-four blocks were tested in compression—six in columns one block high, two columns two blocks high, two columns three blocks high and two columns four blocks high. To give an even bearing on the machine, the columns were bedded in plaster, and to give an even bearing on each other in the column one series of blocks was cemented into columns with plaster, the other series with neat Portland cement. This difference of bedding material, however, gave no appreciable variation in results. All columns failed in similar vertical planes through the partition walls. The results of the compression test are as follows, the 200,000 pound Riehle vertical testing machine being used:

LOADS IN 1,000 POUNDS.														
No. of test.	No. of columns tested.	No. of blocks in column.	First Crack.						Maximum.					
			Total.			Lbs. per Sq. In.			Total.			Lbs. per Sq. In.		
			Max.	Min.	Avg.	Max.	Min.	Avg.	Max.	Min.	Avg.	Max.	Min.	Avg.
1	5	1	195	106	146	2.19	1.15	1.63	195	107	152	2.19	1.17	1.68
		2	145	106	126	1.63	1.22	1.43	145	115	130	1.63	1.32	1.47
		3	145	100	123	1.63	1.15	1.39	163	115	139	1.63	1.20	1.41
		4	146	119	133	1.63	1.36	1.49	146	119	132	1.63	1.36	1.49

Weight.

The average weight per block was 55 pounds. The average weight per cubic foot of material was 147 pounds.

Absorption.

Half blocks, after drying two days in the heating oven, were immersed in water and absorbed 6½ per cent by weight after four hours' immersion. After four days immersion this per cent of absorption increased only ½ per cent. On immersing the face only, it absorbed 2.3 per cent of the weight immersed in four hours.

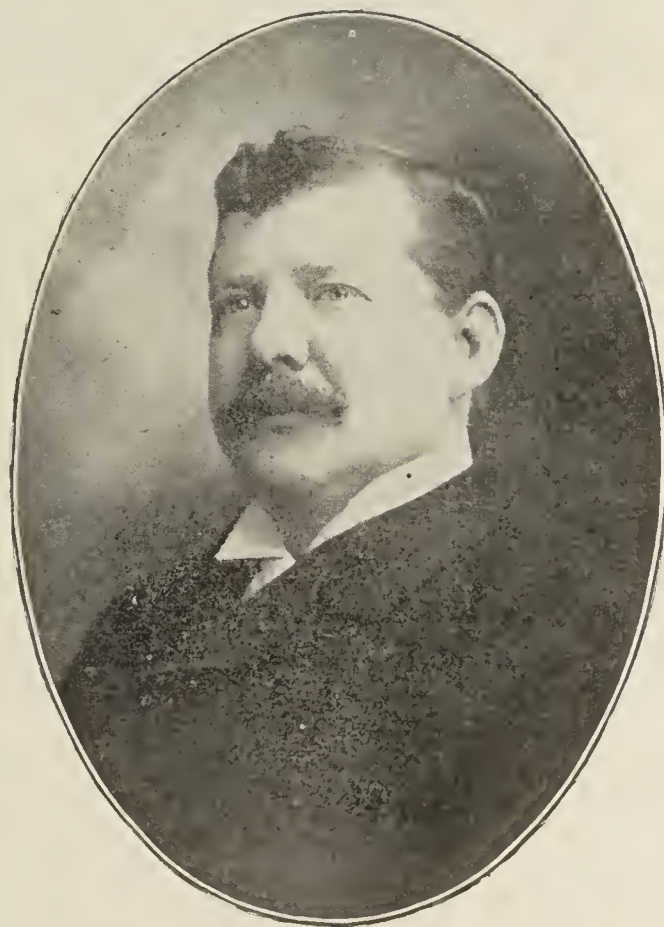
Summary.

The results of the test then show that the modulus of rupture is 241 pounds per square inch, which is 85 per cent of that determined by Fuller for 1 : 3 : 5 concrete beams. The strength per square inch in compression averages 1,500 pounds, or about 60 per cent of the strength of solid cubes and cylinders of 1 : 2 : 5 concrete as given by various authors. This compressive strength shows little variation for columns up to four blocks high.

Results throughout the test checked with fair uniformity.

MARTIN T. ROCHE.

Martin T. Roche, Secretary of the North Western Cement Products Association, resides at St. Paul, where he represents the Alpena Portland Cement Co. Mr. Roche is a man of affairs, and whenever he puts his shoulders to the wheel something must move. He



is an enthusiastic worker and leading member of the North Western Cement Products' Association, for whose interests he spends time and money and always produces the goods he is after. He is an untiring worker, and this is the secret of his extraordinary success in all matters he takes in hand.



Members of the Northwestern Cement Products' Association at the Miracle Pressed Stone Company's Works, Minneapolis, Minn. (See page 4.)

IDEAL WINS.

Canadian Court Declares Ideal Concrete Machinery Company to Have Only Valid Patent Covering "Face-Down" Concrete Block Machinery.

A recent court decision at London, Ont., rendered in favor of the Ideal Concrete Machinery Company of South Bend, Ind., leaves this concern in practical control of the manufacture and sale of face-down, horizontal core concrete block machinery.

The patent, the validity of which is now so firmly established, was acquired from the original inventors, Messrs. Borst and Croscop, by the Ideal Concrete Machinery Company, and thoroughly covers the process of manufacture of face-down concrete building blocks.

Early last spring, Mr. Henry Pocock, of London, Ontario, opened negotiations for the purchase of rights of manufacture of the Ideal machine under the Canadian patent. After a visit to the Ideal Company's factory at South Bend, and an examination of the Ideal Machine and the method of its manufacture, negotiations were suddenly broken off, Mr. Pocock returned to Canada, and after constructing a machine similar to the Ideal, sought to patent it. In August last he began offering this machine for sale. The Ideal Concrete Machinery Company learned of this, and immediately sought an injunction of court, restraining Mr. Pocock from making, selling or dealing in the machine, alleging that it was a wholesale appropriation of their invention with some changes and complicating additions. The decision just rendered is the result.

After a trial lasting nearly three days, in which expert evidence was introduced from Toronto, Detroit, Fort Wayne, Audobon, Ind., and London, Ont., the court gave a clear and exhaustive summing up of the contentions of the parties, in which it was declared that the plaintiff's patent was a good and valid one, thoroughly protecting the invention sought to be covered by it. It was held that the machine sold by Pocock was an infringement on the rights of the plaintiff, and the defendant was enjoined from ever again, at any time, making, selling or in any way dealing with the machine in question. Plaintiff was given costs of action, and all orders for the infringing machine taken since the interim injunction was granted in September.

The Ideal Company is arranging to enlarge their plant at South Bend, Ind., for the manufacture of the Ideal Machine, and is opening a large plant at London, Ontario, for the manufacture of Ideal Machines for the Canadian trade.

NOTICE.

The Century Cement Machine Co., of Rochester, N. Y., report a strong demand for the 1907 Hercules, and have prepared for an unprecedented business in 1907. Progress is the keynote throughout the factory where the Hercules is made, and the 1907 model shows that improvements have been made wherever possible. The machine as it stands today is a giant in strength and there is no denying the fact that its strength lies in the wonderful simplicity of mechanism. Indeed it is really marvelous how such a simply constructed machine can turn out such a variety of designs and sizes of Blocks, Sills, Lintels and Ornaments. In many of the large contracts for Concrete Construction which were completed last year all blocks were made on the Hercules. The immense power house of the New York, New Haven & Hartford Railroad at Cos Cob, Conn., and a large building for the General Electric Co., at Schenectady, are two instances.

The Hercules has also jumped into favor abroad, for export orders have been plenty during 1906, and machines are in operation in nearly every country in the world.

MAKE CAPITAL \$1,000,000.

Crescent Cement Company Increases Stock to Issue to Erect New Mill in Lawrence County.

Stockholders of the Crescent Portland Cement Company, Pittsburgh, Pa., in annual session have voted to increase the capitalization of the company from \$150,000 to \$1,000,000. The principal reason for the increase is to provide funds for the erection of a new mill in Big Beaver township, Lawrence county. The present mill of the company, the second oldest in the United States, was erected in 1874 by Shinn brothers.

Directors elected were: The Hon. J. Sharp Wilson, Beaver; G. W. Hackett, Pittsburgh; C. M. Hughes, Beaver, W. J. Prentice, Pittsburgh, and R. H. Hughes, New Castle. W. J. Prentice, formerly president of the Castalia Portland Cement Company, was elected president; C. M. Hughes, vice president; R. H. Hughes, secretary and general manager; G. W. Hackett, treasurer;

the Hon. J. Sharp Wilson, assistant treasurer.

SAFETY IN CONCRETE CONSTRUCTION.

Presidential Address of Richard L. Humphrey before the National Cement Users' Association.

We are indeed in the age of cement and it is apparent that this infant industry which burst its swaddling clothes but a few years ago, has become a lusty youngster—its growth outstripping the dream of its most ardent supporters. We are passing through an era of unparalleled prosperity which has occasioned an activity in the world of construction demanding enormous quantities of cement, thus advancing the yearly consumption to figures which are a hundred-fold greater than those of a dozen years ago. When Germany, our principal competitor, topped a yearly production of 20,000,000 barrels, we regarded it as wonderful, yet a half dozen years later our own production has doubled these figures and we now are the largest cement producing country of the world. It is hard for even the cement user to follow the meteoric progress of the production and consumption of cement. A progress so rapid that the friends of this material of construction must needs pause and consider the danger which may await a too rapid pace.

As I took occasion to remark a year ago, cement has its weaknesses and limitations and these should be faced squarely by its advocates and pointed out emphatically, thereby preventing abuse which tends to dim its unsurpassed qualities. Of the materials of construction cement it is at once the most delicate and the most valuable—a plastic material, whose properties we are only just beginning to appreciate and understand. Its extensive use is not because its qualities are well developed and recognized, but because its cheapness renders it an effective competitor of other building materials both in strength and fire resisting qualities.

Great catastrophies and overwhelming disasters of all kinds, while resulting in great hardship and suffering, teach lessons of incalculable value. On the 18th of April of last year the entire civilized world stood aghast at the appalling destruction which visited the city of San Francisco and vicinity—the result of a slip of the earth's crust. To the constructor and user of the materials of construction the most interesting feature was the beha-

vior of the various materials of construction under those unusual and rigorous conditions. This was a test of such unusual violence that only the structure begotten of first-class materials and design and honest workmanship could survive. Flimsy and loosely erected structures were shaken to the earth and collapsed like houses of cards under the terrific wrenching and shaking of the earth. Those structures which survived the earthquake test were, in many cases, subjected to a fire test exceeding in extent in its intensity all the great conflagrations of recent years. Many structures which successfully withstood the first test failed signally under the test which followed by reason of the inadequate fireproofing. Other structures failed under both tests, while a very few withstood both tests successfully.

The study of the relative efficiency of the various materials of construction under these conditions is most interesting. It is a generally accepted fact that no structure can withstand the stress produced by the movement of the earth on the "fault line." The effect of the shaking and vibrations of the earth in the territory affected could be resisted, and the secret is proper design, first-class materials and honest workmanship. In tall structures rigidity of construction and stiffness, the result of adequate wind and portal bracing, is absolutely essential. While reinforced concrete structures in the zone of seismic disturbance were few, these passed the test in a highly satisfactory manner. Rigidity and stiffness and a high fire resistance which are inherent qualities of this material demonstrated how admirably they were suited to resist this extraordinary test.

This test seems to be greatest for structures built in low lands—on alluvial soil in the valleys of rivers—where the settlement of the earth under the earthquake vibrations was very great. On solid ground and rock formations the test was much less severe. Structures at points of great destruction such as Palo Alto, San Jose, Salinas, Santa Rosa, etc., were built on soft material as indicated. The buildings of Stanford University suffered severely, most of the buildings being wholly or partly destroyed by the earthquake shock. The types of construction represented were stone, brick and stone veneer and concrete—the latter not being reinforced except at the floor lines. The buildings of the latter type passed

the ordeal successfully and demonstrated the superior qualities of a material possessing great adhesive qualities. The great concrete dam at Crystal Springs reservoir gave additional proof of the substantial qualities of concrete for, although within a few hundred feet of the fault line, it suffered no damage.

At Palo Alto and Santa Rosa the failure of concrete block buildings has been pointed out as examples of the failure of cement to withstand the test. At Palo Alto three cement block buildings collapsed. No other result could have been expected, when the method of construction is considered. The blocks were laid up without a tie of any kind, and the floor joists and roof timbers either rested on or were built into the wall without any tie. Under the movements of the earth the walls were pushed out of line, the wooden members of the structure not being tied to the walls, there was no means of restoring the wall to its former position and it collapsed. In one of the buildings the gable end of the roof rested against the wall and served as a battering ram.

That such structures can be so built as to withstand earthquake shocks is evidenced by the building at Santa Rosa also built of cement blocks, but differing from those just referred to in that iron tie rods held the walls tightly to the floor joists and roof timbers. While the neighboring brick, stone and frame structures collapsed, this building was but slightly damaged along the cornice line. The destruction at this point was perhaps as great as that in any part of the territory affected by the earthquake. At Mills College, just outside of Oakland, there were two structures of concrete, one a bell tower 80 ft. high with 4-in. walls of reinforced concrete, and the other a building with walls of concrete reinforced at the floor lines only. The former was not damaged in any way. The latter building was but slightly damaged by the collapse of the chimneys, which crashed through the roof and floors.

Another reinforced concrete structure was the Cyclorama in Golden Gate Park, which demonstrated the futility of attempting to successfully provide against earthquake shocks where the foundation is bad and the materials poor. The walls of this structure rested on a foundation made by leveling off the top of Strawberry Hill; the aggregate of concrete consisted of a hard shale which made a very inferior

concrete, and a careful inspection of the ruined structure shows that little else could have been expected under the conditions.

In San Francisco proper, in the fire zone, the behavior of concrete was equally satisfactory and there are many cases where concrete successfully passed both the strength and fire tests. There were but two structures of reinforced concrete, namely, the Bekins Van & Storage building and the Academy of Sciences. The former was in process of erection and had reached the second story, while the latter was an old structure. The walls of each structure were of brick and were cracked extensively by the earthquake, while the concrete remained undamaged, both structures being completely burned out, but the concrete was not damaged in the slightest degree. The columns in the Academy of Science building were cast iron, filled with concrete, and in one instance where the cast iron expanded and failed by cracking the concrete core remained uninjured.

Cinder concrete was most generally used for floor construction and behaved in an entirely satisfactory manner.

I think to the unbiased observer concrete gave sufficient evidence of its ability to resist both earthquakes and fire; its rigidity making it an admirable earthquake material, while its extremely low rate of conductivity for heat makes it a fire resistant of high order. The San Francisco earthquake, with the resultant conflagration, will be of inestimable value for the future constructor in furnishing reliable evidence of the value of the various classes of material, and the record is but another testimonial of the admirable properties of cement. Its strength and durability, its cheapness in comparison with other materials of construction places it in a position in which its future is absolutely secure. We are not fully conversant with its properties, its strong and weak points, and it behooves us to go slow and not be precipitate in its indiscriminate and reckless use.

The bold design in reinforced concrete, when taken in connection with the lack of a definite knowledge of some of the factors required in such design, is venturesome to say the least. Nor is this venturesome spirit confined to reinforced concrete alone. Plain concrete is used under conditions requiring reinforcement and building blocks are used for purposes to which they are

utterly unsuited and under conditions which are dangerous.

Wherever failures occur, it is generally cement that has to bear the blame. And on this material all the sins of omission or commission are heaped, and yet it should be noted that it is extremely rare that failures are traceable to the quality of the cement used. Where an unbiased examination is made, the failure is generally found to be due to bad workmanship, improper design, insufficient strength and a too early removal of the forms for the construction of all of these, and many failures occur from improper material, insufficient mixing, improper consistency of effective tamping. In these days of machine mixing too little attention is given to the rigorous inspection of the process. As an illustration of this point I would state that on a large piece of work the system used in the mixing of the concrete was such that the sand was thrown in by one man, the crushed stone by another and the cement by a third, the latter being called away from his post failed to perform his part, but during the interval the sand and stone went in with rhythmic precision. It is obvious what the effect of these batches of concrete would be and how fatally they would affect the strength of an important part of the structure. In another case which I have in mind the cement, sand and stone were fed automatically from hoppers so adjusted as to give the requisite proportion. At the time of this inspection the cement hopper was choked, but the sand and stone were flowing on and the operator who was totally unaware of the fact, remarked, when his attention was called to it that he thought the concrete looked rather peculiar. Perhaps the greatest source of failure is the strength of the forms; too little attention is given to the design of these forms and they are often made entirely too light for even normal conditions and where a temporary load in excess of that for which the structure was designed comes upon it the structure is either dangerously strained or collapses. I have in mind cases where excessive quantities of cement have been stored on the green concrete structure, and in one instance producing a collapse of the floor panel.

Concrete of improper quality is often used and I recently saw in New York cinder concrete consisting of one part of cement and five parts of cinders going into a rein-

forced concrete structure. Again, the length of time which should elapse before the centering is removed has a marked bearing on the question of failures. The time required for concrete to harden sufficiently to permit the removal of the forms is naturally a variable one, depending on the design, the weather condition, and the strength of the concrete. A concrete with a small percentage of cement will require a longer time to acquire the requisite strength than a richer mixture; it will also take concrete longer to harden in cold than in warm weather and a beam of long span must be stronger than the one of short span before the form can be removed.

Another source of failure is the lack of attention to details, especially as regards connections in the erection of a structure. The structure may be properly designed with the requisite amount of steel, yet the structure may be fatally weakened by the character of the connections. A reinforced concrete structure should be practically a monolith—the tension members must be continuous in beams and columns. It makes a material difference as to the length of the splice allowed in such columns or whether the splice in continuous beams is adequate. I have in mind an instance which came to my notice of an enterprising laborer who, observing the rod in a column projecting out of the concrete in the column of a several story building, seized a sledge hammer and drove the bar down flush with the surface of the concrete. The remedy for all this is inspection, most careful inspection.

No more unstable material is in use today than cement. From the moment it is reduced to an impalpable powder it undergoes changes which seriously affect its quality. Unlike steel, wood, or similar materials, it does not stay tested and its quality must be ascertained before use. When we consider the way in which so delicate a material is handled by unskilled laborers it is not surprising that failures should occur. A steel beam or channel is fabricated at the mill and undergoes during the process of manufacture a most rigid and careful inspection; and in the erection again undergoes careful inspection. On the other hand a concrete structure is fabricated on the site and is subject to little, or at the best, indifferent inspection and the unintelligent laborer contributes to the abuse. The same careful and rigid inspec-

tion should be given the erection of a concrete structure as a steel structure receives and until this is done we may expect failures.

The comparatively few failures in concrete structures are allowed to overshadow the great number of excellent examples of well-designed constructions of this class. And it should be noted that what failures there are, occur during the process of erection and are almost invariably due to a too early removal of the forms or bad workmanship. The failure of a structure of concrete by reason of improper design, bad workmanship or poor materials no more affects the value of concrete for constructive purposes than the failure of a structure of steel due to similar conditions should condemn steel for structural purposes. We may expect failures as long as incompetent men will undertake to design structures in concrete and unskilled and ignorant persons will attempt to "skin" the work for the purpose of increasing their profits; and it will only be the continual loss of life that results from these failures that will bring the authorities to such a realization of their responsibilities as will result in laws which will properly safeguard the public.

Amid the ignorance and wonder that attends the use of a new material the charlatan practices his art unchecked, new forms of patented construction are constantly springing into existence, many absolutely devoid of merit, and the public are being proportionately humbugged and deceived. Plans and specifications are generally prepared by the contractor and for every skilled competent contractor, there are many who are incompetent, who do not hesitate to skin the work in order that they may finish it without loss of profit, having taken it at a figure entirely too low to admit of proper workmanship with first-class materials. Such practices are wholly unnecessary, for first-class legitimate construction can successfully compete with other forms of construction and there are many reliable concerns capable of executing such work.

Owners, architects and engineers are criminally responsible where they award work to irresponsible contractors lacking in the requisite experience and knowledge for safe construction, or who permit structures to be erected under the direction of competent persons who do not give the work their personal supervision. Where the charlatan reaps his greatest harvest is

through the medium of the beguiling literature giving strength values based on tests primarily made for the purpose of developing and exploiting of the strongest features of the system for which he holds the patent. Many concerns rush in with inadequate experience, acquiring this at the expense of their clients.

The present condition of the art of concrete or reinforced concrete construction is not unlike the condition of the iron business in its early history, not so many years ago. The knowledge relating to the construction of highway bridges was at that time largely vested in the contractor and it was the practice for the contractor to submit bids for bridges based on his own plans and specifications. The number of failures of highways was directly attributable to this fact, and it finally drove the constructor into making his own designs and specifications, with the result that the contractor bid much more closely and intelligently on a definite plan and specification, and failures in such structures became largely a thing of the past.

This experience, I believe, will be repeated in the case of structures of cement. In the meanwhile a knowledge of the properties of concrete is more fully established, its strong and weak points more thoroughly understood; it behooves us to go slow and be more conservative and careful in its use. The failures which occur from time to time unquestionably hinder the development of the industry in that they cast doubt upon a comparatively new material and make builders cautious in its use. I would repeat that we should recognize the weak points of cement and further see to it that its good points are not abused. It will only be by determined action that the present abuses can be curbed and the fair name of concrete preserved.

It is the duty of every user of this material, of every friend to join most heartily in the cause. Let each of us put our shoulder to the wheel, thereby controlling this rapid movement in the application of cement to constructive use, lest it get away from us and run on to destruction. We should not be afraid to state the truth, even though it hurts; we should by all means be honest, and not hold malice toward those who frankly call our attention to the new weaknesses in the most magnificent building material at the command of the constructor.

The Hampton Cement Construction Co., of Hampton, Iowa, has been organized with Jacob Pohl, president; E. A. Beebe, secretary; F. H. Ridgeway, treasurer.

The American Cement Company has re-elected the old board of directors as follows: George W. Norris, Edward Wolf, J. W. Eckert, Frank G. Thomson, J. H. Catherwood, R. K. Cassatt, Charles S. Farnum, Robert W. Lesley, G. H. B. Martin. The stock certificates heretofore divided into shares of \$10 each, are to be consolidated into shares of \$50 par value. Each five shares of the old \$10 will be converted into one \$50 certificate.

The earnings of the company for the year ending Nov. 30, 1906, was 14.4 per cent after retiring \$47,000 of the bonded indebtedness, while in 1905 only 9.9 per cent was earned.

Cement material has been located between Hays City and Russell, in Ellis and Russell counties, Kansas. Half a car load of the material has been sent to a large cement plant in Pennsylvania for investigation. If the material proves satisfactory a company is to be formed with a capital of \$350,000 to erect a plant.

Geo. T. Butler of Peru, Ind., heretofore connected with stock sales department of the Toledo Portland Cement Co., has been placed under arrest on the charge of misrepresenting the company's assets, a warrant being sworn out charging him with obtaining \$12,000 on false pretenses from railroad men and merchants of Peru. The Toledo Portland Cement Co. is now in the hands of a receiver who will wind up its affairs.

To the George A. Fuller Company will fall the honor of erecting the largest single structure for which a permit has ever been issued in the city of Chicago. They have been awarded the contract for the Montgomery Ward & Co. building, which is to be erected on the land recently acquired by that firm at Chicago avenue and the north branch of the Chicago river. This building will be remarkable in many ways. Remarkable on account of its immensity, being eight stories and basement high with an area of 140,000 square feet to a floor, and from the fact that it will be the largest structure built entirely of reinforced concrete ever erected in this country. Some idea of the magnitude of the enterprise may be gained from the amount of mate-

rial which is to go into the building. The piling contract calls for 12,000 piles, the amount of Portland cement to be used will be in the neighborhood of 100,000 barrels, and between five and six thousand tons of steel rods for reinforcing. A complete steel plant, also a woodworking plant, will be used by the contractor for assembling these materials. The concrete will be supplied from four stations, which are in touch with eight specially constructed steel derricks. Both in the construction and the completed building everything will be handled as nearly as possible automatically. Superb shipping facilities have been provided for. The building will have rail and water connections and the Illinois Tunnel. One of the most complete carrier systems ever designed for the transferring of merchandise will be installed. The building has been specially designed by Architects Richard E. Schmidt, Garden and Martin to take care of the wonderful business of this growing concern.

St. Louis Portland Cement Company's stock is going up. Preferred is selling at \$98 per share; common \$27 up to \$27.25. This is more than has been asked a few days ago at the exchange.

The Peninsular Portland Cement Co. has declared a dividend of 14 per cent on last year's business. Considering the fact that the company's plant was seriously damaged by fire about two years ago and that the same has been rebuilt, nearly doubled the capacity and met all obligations, with undivided profits of \$222,456.95 after the 14 per cent dividend had been declared, is a remarkably good showing. The following directors were unanimously elected:

W. F. Cowham, Jackson, Mich.
N. S. Potter, Jackson, Mich.
H. Frank Stone, Rochester, Mich.
M. B. Sweeting, Jackson, Mich.
W. C. Anderson, Detroit, Mich.
H. R. Scoville, Ypsilanti, Mich.
F. E. Palmer, Jackson, Mich.
D. C. Griffin, Ypsilanti, Mich.
J. W. Shove, Jackson, Mich.
John B. Holthouse, Decatur, Ind.
W. W. Hawley, Huntington, Ind.
The board of directors later organized as follows:

President—W. F. Cowham, Jackson, Mich.

Vice president—D. C. Griffin, Ypsilanti, Mich.

Treasurer—N. S. Potter, Jackson, Mich.

Secretary—J. W. Shove, Jackson, Mich.

COLD TWISTED LUG BAR.

A new and improved cold twisted lug bar is being placed upon the market by the General Fireproofing Company of Youngstown, Ohio. It is an ideal bar for reinforced concrete construction work. The cold twisted lug bar is furnished in lengths from 14 to 46 feet long, in sections corresponding in sectional area to $\frac{1}{4}$ ", $\frac{3}{8}$ ", $\frac{1}{2}$ ", $\frac{5}{8}$ ", $\frac{3}{4}$ ", $\frac{7}{8}$ ", 1", $1\frac{1}{8}$ ", $1\frac{1}{4}$ " and $1\frac{1}{2}$ " square bars on the following specifications:

"All steel must be made by either the Open Hearth or the Bessemer process, and must have an ultimate breaking strength between 55,000 and 65,000 pounds per square inch, elastic limit not less than 32,000 pounds, and elongation not less than 20 per cent. of a measured length of 8" on a test specimen 18" long.

The elongation after twisting is much less than before. The yielding takes place slowly and uniformly up to about 80,000 pounds per square inch, there being no sudden falling off in the load carrying capacity. The ultimate strength is above 84,000 pounds per square inch.

"All bars must bend cold, 180 degrees to a diameter equal to the thickness of the bar without sign of fracture on the outside of the bent portion. All bars must be straight and free from wind."

Chemical Properties: "Carbon, approximately .12 per cent. Sulphur not more than .08 per cent. Phosphorus not more than .10 per cent."

The Cold Twisted Lug Bar is designed with the view of securing a maximum resistance to slipping, and at the same time high elastic limit and negligible elongation within working limits. The lugs are placed on surfaces at a maximum distance from the axis of the bar where they effectually resist the tendency to untwist under tension, thus preventing splitting at the corners. The section of the Cold Twisted Lug Bar is free from sharp angles, the object of this being to prevent the starting of cracks in the concrete.

Among the numerous advantages of the Cold Twisted Lug Bar are:

The elongation reduced by Cold Twisting.

Every bar is increased in strength by the Cold Twisting.

Every bar is thoroughly tested by the Cold Twisting.

Inferior steel cannot be twisted cold, it must be twisted hot.

Our illustration shows the form of the bar, from which it will be seen that it possesses distinctive features that must prove valuable as a reinforcing member in concrete work, inasmuch as it combines all the valuable features of the twisted bar as well as the corrugated bar. We are informed that these bars are furnished cut to lengths as required for the work in hand.

MILE ROCK LIGHT STATION, SAN FRANCISCO HARBOR.

The U. S. Government has constructed a new light house at the entrance of San Francisco harbor, on a small jagged rock, the points of which rise only 16 feet above the Pacific ocean at extreme low tide. A broad shelf was cut around the outer edge of the rock to receive an elliptical shaped steel shell made of heavy boiler plate, 42 feet long, 25 feet wide and 42 feet high. After the shell was in place it was filled in with concrete and tamped around the jagged points of rock. From this foundation rose the light station proper 55 feet high, it is constructed of steel and concrete. The cost of the structure was \$100,000. It successfully resisted the earth quake shock, and several severe storms which swept over San Francisco harbor where shipping and buildings were wrecked without the least injury to Mile Rock light station. The illustration on the first page shows the exterior of this light station, San Francisco.

CONCRETE PREFERRED TO SAND STONE IN SAN FRANCISCO.

Among the natural buildings found in California, none stand higher than sand stone, in the opinion of architects, contractors and builders, the best being quarried in Colusa county. Even this stone has its limitations, as was clearly demonstrated in numerous instances in the earthquake at San Francisco. For instance the lower half of the exterior walls of the lofty tower of the magnificent Ferry building was constructed of Colusa sand stone, carried on steel framing some 300 feet above the street level. The fire after the shock developed large

cracks and seams in the stone, leaving the walls standing in a weak and unsafe condition and was therefore condemned and the walls reconstructed in reinforced concrete.

The finished tower is shown in our illustration on the front page. The dimensions of this reinforced concrete tower are as follows: height of tower above the roof 100 feet, by 40 feet square at the base. The entire square section was enclosed in wooden forms of ornamental design. The concrete being poured to produce the effect shown. The average thickness of the walls being about two feet, cast in a single piece. This piece of work forms a conspicuous land mark and is most admired by engineers and architects, who likewise pronounce this tower sufficiently strong to resist earth quake shocks successfully, which can not be said of any other building material outside of concrete and steel. Thus concrete is continually advancing in public favor, as a cheap, strong and durable structural material, notwithstanding the numerous underhanded and unfair attempts to cry it down by rival competing vested interests it is so rapidly displacing.

Careful estimates of the daily consumption of Portland cement in San Francisco building construction is placed at 8,000 barrels, while the adjoining towns and just outside of the city proper brings the consumption up to from 10,000 to 12,000 barrels per day. The stormy weather in December and the latter part of November has restricted building operations. When the weather conditions improve much larger quantities of cement will be used. The California cement mills have not been able to meet the increased demands as they were full of orders in 1906 before the earth quake and are not yet in position to increase their output although extensive improvements are under way which are expected to be finished by midsummer. Several new cement mills under way. The scarcity of labor and materials are hampering the new as well as the old mills in pushing constructions. This with the delay in having orders for heavy machinery filled in time from the East likewise contributes to the delay in completing enlargement of old plants and new mills. Ground has been broken for a new plant at Riverside, California, to be known as the California Portland Cement Co., capital \$2,500,000. The reported daily capacity is to be 5,000 barrels per day.

WANTED.

Position as chemist in Portland cement. Have had splendid technical training. Can give best of references. Address "Hustler," care of Cement & Engineering News.

WANTED.

Chemist for cement plant. State education, experience, references, salary expected; must have cement experience. Address Box 88, La Salle, Ill.

PARTIES

Wishing to purchase the State rights of the Stevens patents for cast stone, known as litholite and roman stone, will please address,

URIAH CUMMINGS,
Akron, New York.

WANTED AT ONCE

Two Mechanical Draftsmen experienced in design of cement plants.
The Osborn Engineering Co.
Cleveland, O.

SUPERINTENDENT OF PLANT

Wants position of Superintendent or designing Engineer, technical graduate, good record, good references, at liberty after March 1st. Address "Copper," care of Cement & Engineering News.

WANTED

Position as assistant chemist in cement plant by a university educated man with experience in "limestone" process. References furnished. Address P. H. W., care of Cement & Engineering News.

WANTED.

Civil engineer with seven years' practical experience in cement district of Pennsylvania, as general manager, chief engineer, designer and constructor of cement plant, wants position. Would prefer designing and construction on new plant. Address "Civil," care of Cement & Engineering News.

WANTED

A thoroughly Competent Engineer with experience in building of cement plants will be wanted in January to assist in construction work. State experience, salary wanted, references. Address A. A., P. C. W., care of Cement and Engineering News.

CHEMIST WANTED.

For an old established Portland Cement Plant, must be thoroughly competent. State experience. A good opening for a reliable Chemist on rock and shale. Address, "H. B.," care of Cement and Eng. News.

EXPERIENCED

Cement expert and superintendent with draftsman, electrician, general foreman, department foreman, millwrights, burners, machinists, steam engineers, also chemist and physical tester, desires change, preferably to new company. References if desired. Address Q, care Cement & Engineering News.

WANTED — Energetic young man with technical training (graduate) for large cement mill to assist superintendent. Address, I. C., care Cement & Engineering News.

WANTED

Position as Chemist, 3 years' college training and four years successful experience as chemist at cement works. A reference. Address Box 13, care Cement & Engineering News.

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State or county license of a cheap process of making high grade granite imitation for building and ornamental work, fire and damp proof, magnesium floor and insulating work; colored inlaid cement floor and pavement tile. Address Julius Ruff, care Cement and Engineering News.

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On account of re-arrangement of our grinding department, we offer for sale $\frac{3}{4}$ 'x16' Smidth Tube Mill Shells with Silex lining. All in A1 condition. Alma Cement Co., Wellston O.

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Position as Construction Foreman or Superintendent for out of town work, also acquainted with laying of cement blocks. Eight years experience. First-class references. Competent to lay out work. Address, C. B., care CEMENT AND ENGINEERING NEWS.

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5 Rotary Coolers, 36 in. diameter, 22 ft. 8 in. long.

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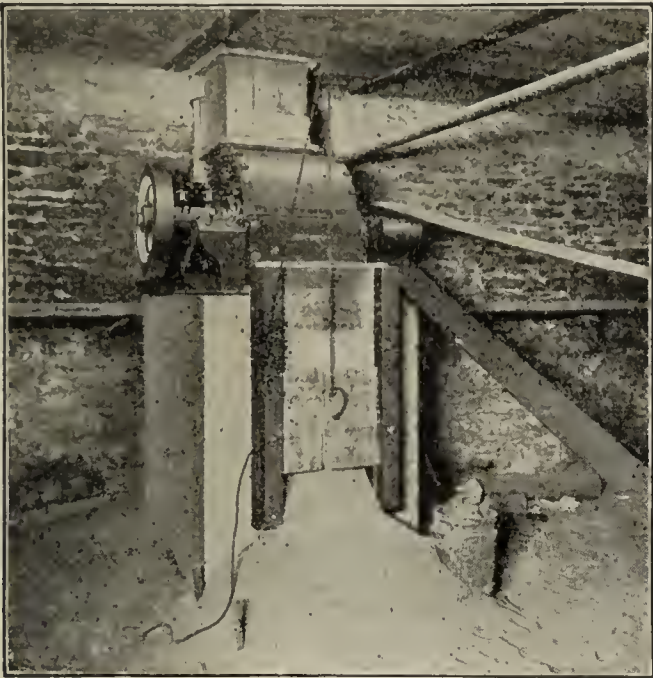
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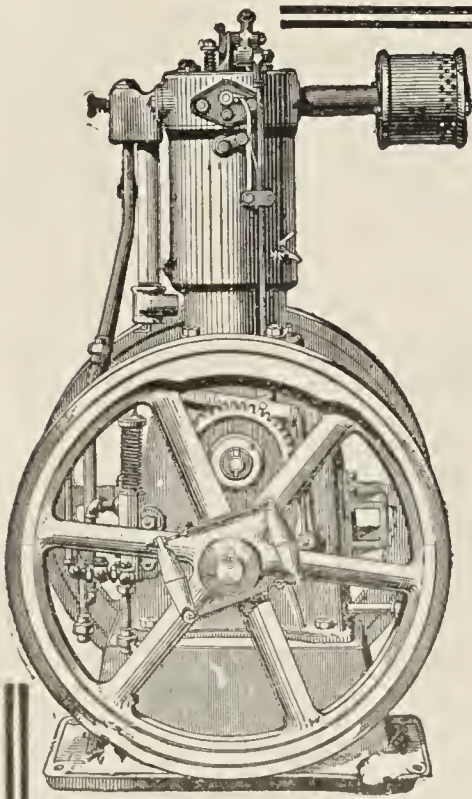
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WHOSE DUST
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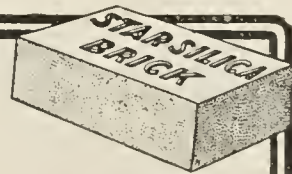
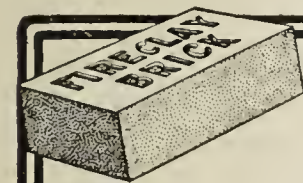
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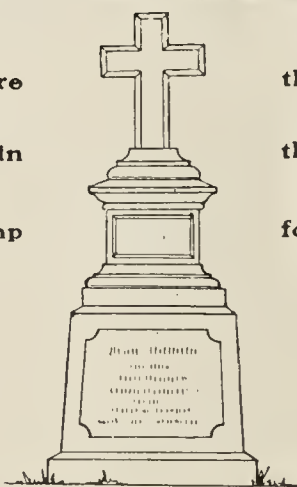
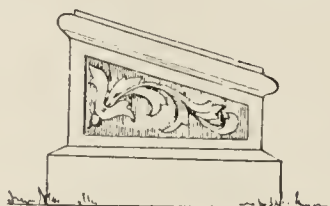
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Blocks of EVERY SIZE, LENGTH, ANGLE, HEIGHT and CONTOUR produced with ASTONISHING EASE AND RAPIDITY.

A MARVEL OF INGENUOUS ATTACHMENTS to the machine which has made more buildings than all infringers and imitators combined.

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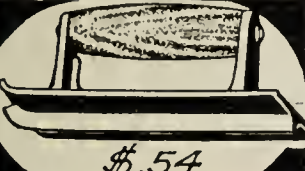
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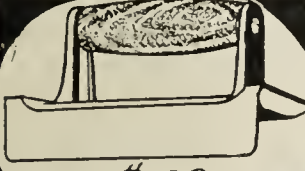
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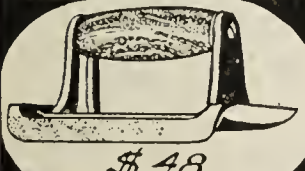
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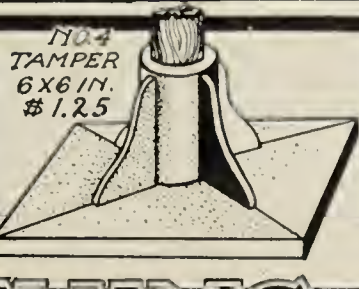
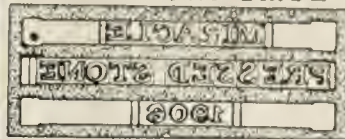


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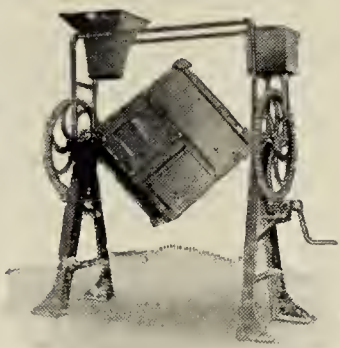
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ANY SIZE ANY SHAPE

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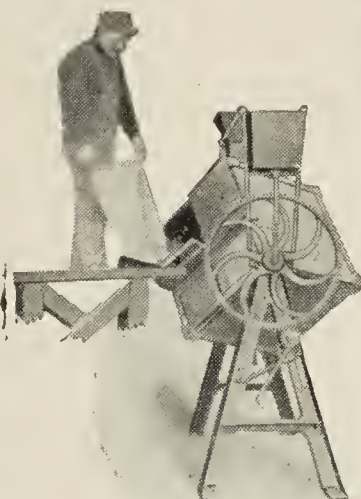
cube three or four times and then without stopping the mixture let in a certain amount of water by means of a simple cock stop and then turn a few more times.

The water is held in a tank above the mixer and a perforated pipe runs from this through the axis of the mixer. The pipe which does not come in contact with the mixture is the only thing inside the cube as the sides are perfectly smooth. No paddles, no gears, no screws to clog the machine or cause trouble. The mixer is always in readiness. It is easily and quickly filled and discharged. Everything works like clockwork insuring a perfect mix and lots of it.

The Miracle Mixer is the only Mixer of its kind. It is the first Mixer ever perfected which requires no gasoline engine or other power to run it. Hand power is all that is necessary, yet power attachments can be applied at any time. It is a wonderful help to the small cement user or beginner as well as to others for it gives him an opportunity of producing the very best mixture at very little expense and with very little money invested. You are in this way able to meet the competition of the largest contractors and to produce equally as

You must have a good thorough mix if you want to produce good results in concrete and thus increase and more firmly establish your business. Every cement user knows this. You must at the same time keep your expenses down if you are to meet competition and make good profits. You are certain of the best results on the least possible investment and labor expense, if you use a Miracle Cube Mixer. Here's the proof.

The cube hung by opposite corners is the most thorough mixer that has yet been devised, because the materials are shifted and broken from side to side six times as each of the six corners of the cube make one revolution. The mixture is turned over three complete times for every revolution of the cube. You turn the



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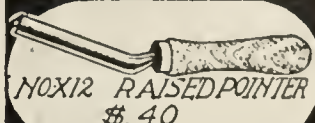
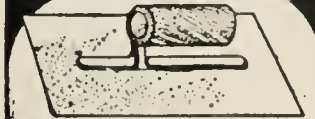
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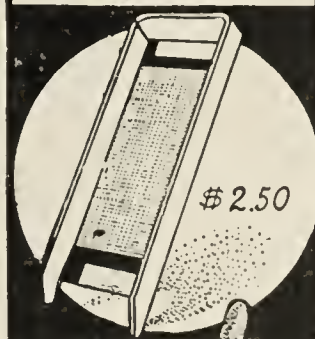
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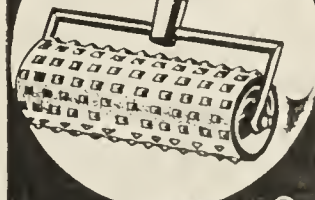
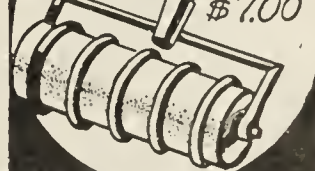
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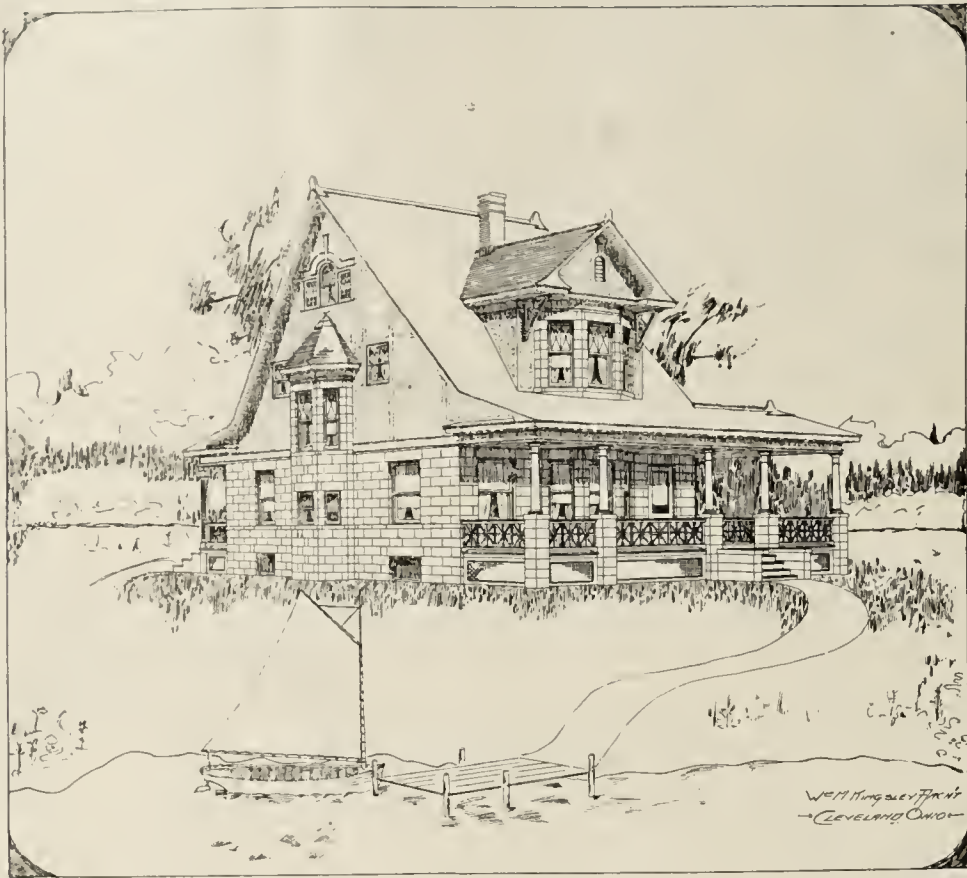
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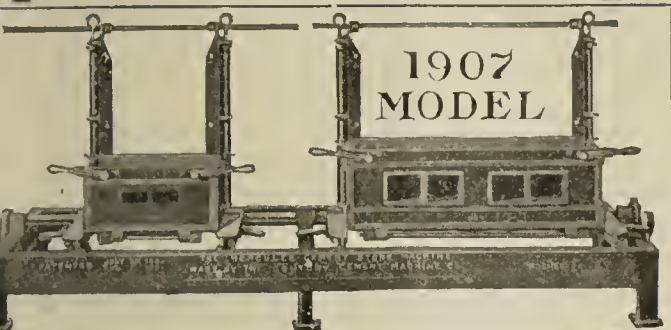
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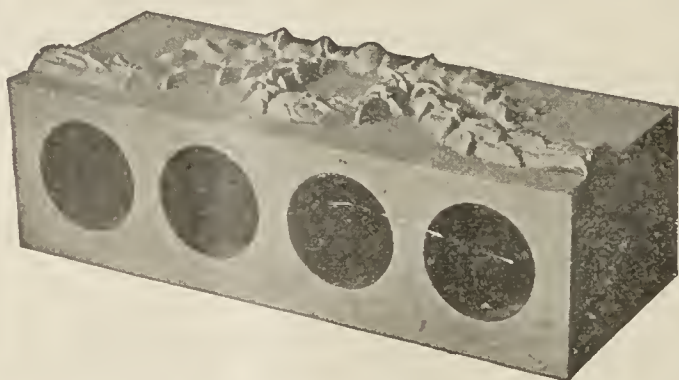
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**Public Bath House in Reinforced Concrete,
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We illustrate a public bath house erected in Bilboa, Spain, in the Moorish style of architecture, after plans by D. Ricardo Bastidan, executed in reinforced concrete. The interior is handsomely finished with Moorish columns in the grand saloon. Individual bath rooms around the sides of the building and a large pool in the center. The coupled arched windows in the second story lend a pleasing effect to the building which is 32 feet 6 inches wide by 22 feet 9 inches high. The entire building including roof is concrete construction.

CEMENT AND ENGINEERING NEWS

(PUBLISHED MONTHLY)

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CHICAGO, FEBRUARY, 1907.

CORRESPONDENCE.

We solicit correspondence on all matters of general interest to the cement trade in all its branches. Engineering notes, public improvements, and facts and opinions drawn from practical experiments will be welcome.

THE VARIED USES OF PORTLAND CEMENT.

Portland cement is now one of the leading materials of construction. Its use is so extensive and varied that even the expert cannot pursue it into its various ramifications. It is and can be properly used to displace brick, stone and terra cotta and granite masonry with economy in both tool finish and rough work. It has likewise excelled the ordinary hydraulic cements for building and street foundations. Curb walls, monolithic bridge structures and mortar for laying up brick sewer work. It is used for lining the water ballast compartments of steel ships and especially in our man of war ships. It has been used for deck construction, top finish in some of our large iron ore carriers on the fresh water inland lakes. It is rapidly displacing brick in large sewers and tunnels as well as clay drainage tile. Great chimney stacks of cement and steel are coming into use. Some of these cement and steel chimneys are over 350 feet high, they are better and stronger than brick chimneys and cost less. Cement blocks and cement brick have made great inroads on clay brick and natural building stone constructions. Cement railway ties have been adopted for entire lines in Europe, where wood is high and scarce. Our own American railways are both inves-

tigating and experimenting with concrete ties. Cement telegraph poles are likewise coming into use, while old telegraph poles are being sawed off just above the ground the decayed portion being replaced with cement butts thus replacing the line in a better condition than when originally built at a small fraction of the cost of a new line of poles, our street foundation in all stable pavements are built of concrete. For cement sidewalk and curb and gutter construction it leads all other materials. All mosaic floors are laid on cement foundations. Cement tile are coming into use for floors in public buildings and mercantile houses. Cement roofing tile is displacing slate and clay tile, most of the cement roofing tile factories are far behind their orders. Cement fence posts are being extensively used on farms and for grape culture on a large scale. The railway companies are using these posts on their right of way. Engine beds of concrete have virtually displaced all other materials for this purpose, coal bins, grain storage bins and elevators of reinforced concrete are in extensive use. The skeleton steel construction for large office and factory buildings, is gradually giving way to reinforced concrete construction, the latter being more economical and more durable than steel alone, as well as reducing the fire hazard. Cement burial vaults, portable and built in place, find ready sale. Reinforced cement lumber built in the factory and erected on the building site the same as wood is now on the market for complete buildings. Cement water tanks, gas holders, tar reservoirs, cement tanks and vats for steaming lumber, preparatory to being cut into veneers are now in common use wherever this industry flourishes. Cement piling is largely displacing the wooden piling for dock purposes, and for foundations on land. Railway earth cuts on the right of way are being covered with cement to prevent land slides. Track elevations in our large cities involving the expenditure of millions of dollars for cement constructions are common occurrences.

Pier foundations of concrete carried down to hard pan, often 100 feet deep is now the rule in all sound building construction on treacherous soil. Even row boats constructed in reinforced cement have come down to us in good condition after 52 years use.

Reinforced concrete memorial monuments, over 75 feet high, are now built at a fraction of the cost of natural stone. Stand pipes 106 feet high, 50 feet diameter, in reinforced concrete, have been built 18 inches thick at the bottom by 8 in. thick at the top. The above array of actual constructions in concrete shows to some extent the varied use of this material which will resist the ravages of time for many centuries, as is demonstrated by cement water storage reservoirs and conduits built in that period are still in use in England all government fortifications are now constructed of concrete.

CEMENT IMPORTS INTO S. AFRICA.

South Africa is now a large consumer of Portland cement. In 1903 cement to the value of \$2,500,000 was imported, in 1904 it was slightly less, of which the United States only contributed \$400 worth in 1903. while Germany sent \$341,875 in 1903 and \$529,800 in 1904. England shipped \$217,725 in 1903 and \$252,325 in 1904. England receives a custom preference of a lower rate of duty. The German cement has been loosing ground. The only plant in operation is located near Johannesburg in charge of Ezekiel Davidson, late of the Diamond Portland Cement Co. of Cleveland, Ohio.

CEMENT IMPORTS INTO INDIA.

Cement is in general use in India. The imports of cement as long ago as 1870 were valued at \$50,342, advancing in the fiscal year 1900 to 729,332 hundredweight, valued at \$500,332, and in 1906 to 1,778,428 hundredweight, valued at \$1,070,275. The imports of cement for the first four months of the present calendar year were 574,006 hundredweight, valued at \$333,427. The supplies of cement for India come mainly from the United States, the United Kingdom, Belgium, and Germany. Inferior cement is not wanted, but the best cement is in good demand at good prices.

THE HARDENING PROCESS OF HYDRAULIC CEMENTS.

The reading of a paper on the hardening process of hydraulic cements by Dr. W. Michaelis, Sr., of Berlin at the annual meeting of the Association of German Portland Cement Manufacturers during the last week of February was one of the most remarkable events in the history of the science of hydraulic cements. This paper revealed the last secrets of the hardening process of hydraulic mortars and offered the most manifest proofs and demonstrations for the correctness of the theory that the hardening process of all hydraulic cements is mainly a process of formation of colloids and not a process of crystallization.

Dr. Michaelis has stood almost isolated ever since he offered this theory about ten years ago. Most other investigators could not free themselves from the idea that a process of crystallization is the basis of the hardening process. But this isolation has been the same in every previous phase of Dr. Michaelis' classical research work. His theories and explanations have always been bitterly opposed at the time when they were made public and many years have passed in every single case, until other investigators were convinced of the correctness of his theories and until the public at large adopted his teachings. Thus, for instance he found the greatest opposition when he advocated fine grinding about 40 years ago; and later, about 20 years ago the Association of German Portland Cement Manufacturers as a body opposed his demand for an admixture of soluble silica in the form of trass, puzzuolana or slags in order to protect Portland cement from destruction in sea water. Today the usefulness of such an admixture is universally acknowledged.

In every stage of his scientific life Michaelis has been a generation ahead of his contemporaries. Therefore it is no surprise to us to see him give the most lucid explanations of the apparently very complicated hardening process at a time, when all other investigators are still busily engaged in a debate about the constitution of Portland cement clinker, a subject of secondary importance, at the best a scientific pastime, but no longer a study from which any advantages have to be expected, especially if the researches refer only to part of the elements in question, if the rest of them are omitted in the research

work and if nevertheless conclusions are drawn from such investigations that are afterwards offered to be applied to any possible case of a composition of a clinker.

Through Michaelis' teachings we now know that the composition of the clinker is entirely immaterial to a certain extent, that many different compounds may be contained in the clinker, that some of them are essential, while others may be present or absent, but that, no matter what the composition may be within certain limits, the hardening process invariably proceeds the same way and is due to the formation of a gelatinous substance, a colloid, which becomes solid in time and which is composed of calcium hydro-silicates, calcium hydro-aluminates and calcium hydro-ferrites.

While this hardening process goes on it is accompanied by a process of crystallization of a small percentage of various compounds, which in the beginning contributes to the solidification of the hardening colloids, but which in time impairs the impermeability of the mortar and thus prepares the way for the ultimate deterioration of all hydraulic cements.

The deductions to be drawn from this theory are proved by practical experience: Hydraulic cements are the more reliable and the more durable the more limited the process of crystallization during their hardening; this means that hydraulic cements low in alumina and calcium oxide are the most preferable, as the surplus of calcium oxide crystallizes in the mortar and becomes the cause of formation of crystals of gypsum and calcium-sulpho-aluminate in the presence of aluminates and sulphates, while the alumina forms unstable crystals of calcium aluminate and in the presence of solutions of sulphates the dreaded calcium sulpho-aluminates.

Iron-ore cement must be regarded as and has proved to be an ideal hydraulic cement, because it contains, instead of the aluminates of Portland cement, calcium ferrites which never crystallize. Moreover, iron-ore cement has the greatest resistance to all chemical reactions that come in question; it is the strongest of all cements and yields the densest mortars on account of its high specific gravity, which is between 3.3 and 3.4.

In the foregoing we have touched only the most salient points of Dr. Michaelis' paper which is before us, but will shortly bring in our columns a complete translation, so

that our readers may become familiar with the deductions that form the quintessence of a life study in cement chemistry of a man who took the lead in his science during the second half of the first century of scientific research of hydraulic cements and who thus continued and completed the work of the great Vicat who was at the head of the science during the first half century.

GOOD ROADS IN FLORIDA.

Mr. Alfred O. Crozier, in an address before the Florida State Board of Trade, pointed out that good roads must precede the settlement of the wild lands of the state; that settlers will only locate where communications are good to market their products. While straw, pine, clay and shell roads cost little, they only last a few years, when they have to be renewed. The only practical road to construct is concrete, which will cost less than one-half in Florida than macadam road, would, under favorable conditions cost the same as the concrete road being on the ground. A mile of such road would cost about \$1,000 per mile and would last indefinitely. The Florida board was favorably impressed with Mr. Crozier's remarks and may act upon his suggestions.

The United States Geological Survey has located a deposit of shale suitable for the manufacture of Portland Cement at New Castle, Weston county, Wyoming, on the line of the Burlington & Missouri River Railway. The composition of the shale is as follows:

Silica, 18.10 per cent; aluminum, 6.26 per cent; oxide of iron, .80 per cent; lime, 37.57 per cent. and .76 per cent magnesia. This composition mixed with 10 per cent of pure lime stone will make a firstclass cement material, according to the report of Sidney H. Ball, in charge of the survey.

The New Princess Theatre, 251-255 South Clark Street, Chicago, will be constructed of cement and steel, five stories high and be fire-proof throughout, and cost \$150,000. It will have a seating capacity of 1,460. It is to be finished by November 15, 1907.

Fort Dodge—Prof. S. W. Beyer of Ames, Iowa, will make an estimate of cost for the construction of a concrete dam for developing electric power from the Des Moines river.

TEST OF CEMENT MORTAR AND OF CONCRETE BUILDING BLOCKS.

BY A. MARSTON AND M. I. EVINGER.

PART I.

Tests of the Effects of Ensilage, Manure, Sheep Dips and Cinders Upon the Strength of Cement Mortars.

These tests were undertaken mainly because the college has been receiving so many requests for information as to whether cement could be used safely for the construction of silos, stable floors, and dipping tanks on the farm. There was some question also, as to whether layers of cinders on top of the reinforced concrete roofs of septic tanks would have an injurious effect upon their strength and as to whether manure placed upon cement sidewalks to prevent freezing would be injurious.

The tests were made by Messrs. H. M. Hansen and F. M. Sloane, senior civil engineers at the Iowa State College 1905-6, as thesis work. The tests were made in accordance with the standard specifications of the American Society of Civil Engineers. All briquettes were made 1 part of Iola Portland Cement to 3 parts of standard sand.

The briquettes tested for the effect of ensilage were kept packed in the material in one of the college silos. For the manure and cinders tests the briquettes were buried in heaps of materials. The manure was from a horse stable. For the sheep dip tests the briquettes were kept immersed in the dip solutions. Two dips were tested, one a solution of lime and sulphur, and the other a creosote dip.

The results of the tests are given in Table No. 1 herewith.

Kept in Contact with	Age	Tensile strength lbs. per sq. in.		
		Minimum	Maximum	Average 20 Specimens
Water	7 days	160	220	185
Water	28 days	264	364	318
Water	3 mos.	297	460	371
Water	6 mos.	370	440	406
Manure	*7 days	130	260	186
Manure	28 days	215	376	283
Manure	3 mos.	320	434	373
Manure	6 mos.	390	440	421
Ensilage	7 days	180	270	214
Ensilage	28 days	285	385	328
Ensilage	3 mos.	314	452	384
Ensilage	6 mos.	375	425	399
Lime and Sulphur	7 days	150	250	196
Lime and Sulphur	28 days	190	350	253
Lime and Sulphur	3 mos.	186	308	248
Lime and Sulphur	6 mos.	350	450	402
Creosote	7 days	135	210	169
Creosote	28 days	233	335	290
Creosote	3 mos.	291	415	343
Creosote	6 mos.	375	435	410
Cinders	7 days	*134	224	179
Cinders	28 days	245	365	294
Cinders	3 mos.	278	430	347
Cinders	6 mos.	350	430	390

*Frozen

Study of table No. 1 will show

very little effect, in the long time tests, of any of the various materials investigated.

The tests are too few and imperfect to be conclusive but so far as they go they indicate entire safety, so far as strength is concerned, in using cement for stable floors, silos and dipping tanks on the farm, and in covering cement with manure or cinders whenever desired for any purpose.

PART II.

Tests of Cement Blocks.

The tests of cement blocks were planned to be more elaborate and extensive than the few results we now have to report would indicate. In fact, the tests already made must be regarded as merely preliminary to a much more extensive and reliable investigation.

The tests were made as thesis work by Messrs. R. A. Furrow and R. R. Palmer, senior civil engineering students at the Iowa State College, 1905-6.

The blocks were made on a Miracle machine, by the students aided by a workman from the cement block factory of H. L. Munn & Co. The gravel was from the college pit, but was not nearly as good as that reported upon at the meeting by Mr. M. J. Reinhart.

The results of the tests completed are given in Table No. 2 below.

TABLE NO. II.

Tests of Strength of Concrete Blocks Manufactured by R. A. Furrow & R. R. Palmer.

No. Samp.	Proportion.	Age.	Size.	Dist. bet. Sup.	Transverse Test Ultimate Load. lbs. per Block		Modulus of Rupture. lbs. per sq. in.			Crushing Test. lbs. per sq. in.		
					Air cured	Water cured	Air Cured	Water Cured	Air and Water Cured	Air Cured	Water Cured	Air and Water Cured
2	1:3	2 wk	12x9x24"	18"	5700	5100	305	272	288	1690	1810	1750
2	1:3	4 wk	"	"	6400	6700	340	357	348	1820	1780	1800
2	1:3	3 mo	"	"	11550	8656	616	461	538	2210	2910	2560
2	1:4	2 wk	"	"	5250	5550	280	297	288	1900	2360	2130
2	1:4	4 wk	"	"	7800	7150	416	381	398	1920	1800	1860
2	1:4	3 mo	"	"	9300	7750	447	408	427	2700	2380	2540
2	1:5	2 wk	"	"	4950	5100	264	274	269	1630	1187	1110
2	1:5	4 wk	"	"	4100	6500	219	347	283	1540	1480	1510
2	1:5	3 mo	"	"	9250	10450	494	607	550	2020	2220	2120
2	1:6	2 wk	"	"	4200	4200	250	225	237	840	1060	950
2	1:6	4 wk	"	"	4400	5000	235	267	246	1660	*480	1270
1	1:6	3 mo	"	"	8000		427		427	2050		2050

The tests shown in Table II are not considered numerous or reliable enough to warrant drawing any general conclusions. Note the abnormally high transverse strength of the 1-5, 3 mos. specimens.

So far as they go, the tests show little difference in strength due to curing under water, but it should be noted that the air cured specimens were kept in a moist basement and were frequently sprinkled. These tests go to show that where the blocks are thoroughly protected from sun and wind, and where the

sprinkling is thoroughly done, as good can be cured by air curing as by water curing. The danger in air curing is lack of sufficiently intelligent and faithful care.

The tests also show a general diminution of strength with decrease in the proportion of cement used, but are too few in number to entirely mask other causes of variation in strength.

Perhaps the most striking fact brought out by the tests is the very rapid increase of strength with age. Blocks are yet to be broken in the same series of 6 months, 1 year, and 2 years ages respectively.

AMERICAN CEMENT BLOCK MACHINES IN EGYPT.

Concrete is the favorite building material in Cairo, Egypt. The Century Cement Machine Co., of Rochester, N. Y., has just shipped six Hercules Cement Block Machines to one contractor in that city. This is the second order from the same contractor, as he has been operating four Hercules Machines for two years. It is understood that the last shipment is to be used in making concrete blocks for an elaborate public building of great architectural beauty.

The Argentine Republic has appointed a commission to revise and enlarge the trade marks of Portland cement brands that will be accepted on government work, during the past five years only six brands of Portland cement have been ac-

cepted. The increasing demand requires that other brands be accepted, therefore the revision of existing specifications.

The Southern California Portland Cement Co. will erect a cement plant near Riverside, California.

The Great Northern Portland Cement Co. expects to resume about March 1st under the management of the receiver of the plant.

DENATURED ALCOHOL FUEL FOR AUTOMOBILES.

Comparative tests of the fuel value of gasoline, kerosene and alcohol were made in a trial run from New York to Boston. Three identical cars fired with the three kinds of fuel left New York January 30 at 9:10 a. m. and reached Boston January 30 at 1:15 p. m., covering a distance of 250 miles in two and one-half days over roads covered with from 4 to 10 inches of snow. The fuel consumed by each car was as follows: Gasoline car, $24\frac{3}{4}$ gallons at 20 cents per gallon, \$4.95; kerosene car, $33\frac{1}{4}$ gallons at 13 cents per gallon, \$4.39; alcohol car, $40\frac{3}{4}$ gallons at 37 cents per gallon, \$15.07. Alcohol to be operated economically requires from three to four times higher compressor in the combustion chamber than gasoline. This will require a specially constructed engine with a longer stroke and less space between piston and cylinder head, in order to obtain higher compression. With the proper compression a thermal efficiency of 31 percent has been obtained against 20 to 23 per cent with gasoline. There is, therefore, a future for denatured alcohol when the special machinery is installed for its use. Denatured alcohol is sold in Germany at 29 cents per gallon. This is 8 cents less than the price quoted above, due to the fact that the government pays the manufacturer (mostly farmers) 13 cents per gallon, not directly, but through the alcohol trust, the farmer receives 42 cents per gallon for his alcohol from the trust. The trust in turn receives a bounty equal to the tax on pure alcohol and is compelled to place the denatured alcohol on the market to the consumer at 29 cents per gallon.

A Portland Cement company has been organized at Kobe, Japan, capital \$250,000, by the following persons: Woo Ching-don (naturalized Japanese), Mak Sui Pan (naturalized Japanese), Takigawa Benzo, Kanematsu Fusojiro, Matsukata Kojiro, Kawanishi Seibei, all of Kobe and Yu Hsia-Ching of Shanghai. The plant is to be enlarged from time to time up to 20,000 casks per month. Yu Hsia-Ching is largely identified with railway construction in China and expects to consume much of the cement the new company is to manufacture.

ALUMINITE BRICK.

The Stowe-Fuller Co., Cleveland, Ohio, have just received a large order for their "Aluminate" brick for Portland Cement Rotaries, for the First Portland Cement Co. of South Africa.

This is the second shipment these people have made for the first and largest Portland cement plant in South Africa, where both American machinery and American "Aluminate" blocks are used for the manufacture of Portland cement.

The Stowe-Fuller Co. report a large increased use of their Aluminate Blocks in this country, which are used by the leading Portland cement plants for rotary linings, and have shipped these special brick to England, Japan, New Zealand and Australia for this work.

HARDENING DRY TAMPED CONCRETE.

P. Hanson, of Frederickburg, New Copenhagen, Denmark, a manufacturer of concrete products, describes the method employed in his factory for curing and hardening tamped concrete by the use of wet steam, which requires very little apparatus, which enables him to produce clean uniform and handsome work, at low cost, in a much shorter time than in the ordinary method of open air curing, or enclosed factory work. The mortar used in his work consists of sand, gravel and cement carefully mixed with the least amount of water, just sufficient to hold the concrete in shape after thorough tamping to permit handling after removal from the forms. The newly made work is simply taken out of the form and deposited where it is made. The form is then refilled and tamped as before, alongside of the last block made. When the work room in which the

concrete is made is full, the doors are closed, saturated steam is admitted at atmospheric pressure until the block is warmed through. Where there are no doors, a piece of canvas is hung over the openings. This answers every purpose. The steam pressure is gradually increased, but the temperature of the room must never be over 122 degrees Fah.; at this temperature the steam will deposit moisture on the blocks or other work sufficient to satisfy all requirements for good sound work. After the stone has been warmed through and through the wet steaming process is continued for from four to six hours or over night, where the curing is commenced in the evening. The steam is then shut off and the work covered with canvas in order to permit the cooling to take place at the slowest possible rate, the manufacture of blocks or other cement ware is then commenced at another part of the factory. In 24 hours the cured stone can be removed either stocked in the factory or out of doors, or carried directly to the work where they are to be used, the work under this process will be clean and sharp and uniform in color, as well as hard and sound.

THE JEFFREY MFG. CO.,

of Columbus, Ohio, has issued for circulation two small catalogues describing coal and ash handling machinery with numerous illustrations, showing cuts and plans of installations for power plants, mills and factories, which will be appreciated by manufacturers desiring to cut down expenses.

The Maryland Portland Cement Co. will build a large Portland cement plant in Maryland. De Coney W. Tohom, president, Baltimore, Md.

IMPORTS OF CEMENT INTO THE UNITED STATES.

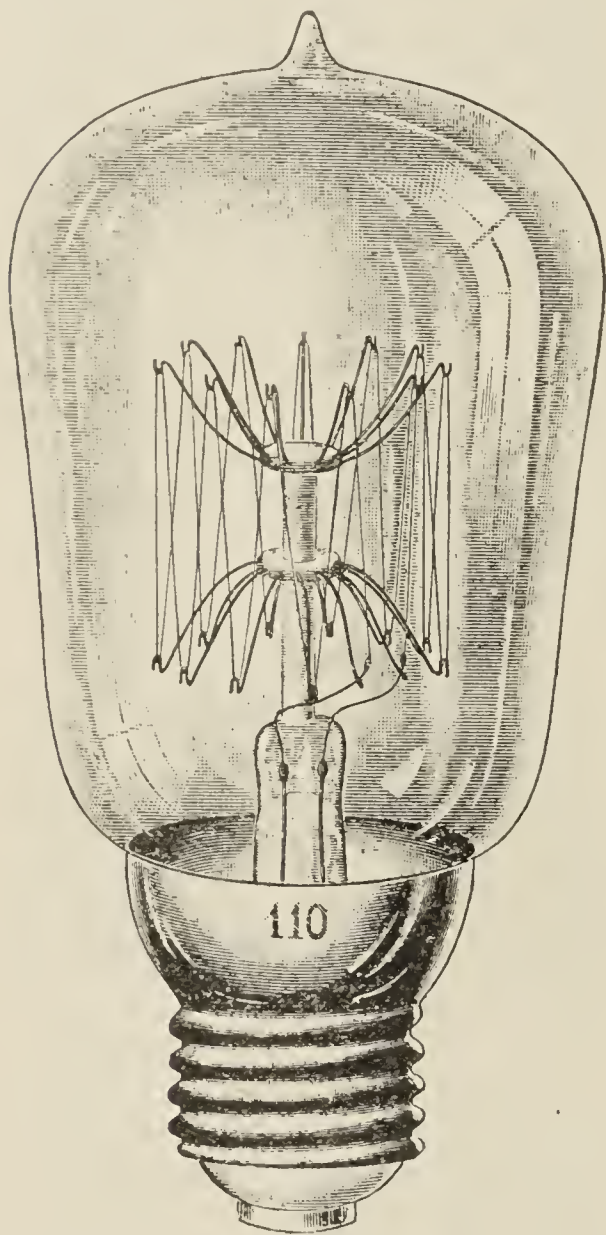
WHERE FROM	DECEMBER				TWELVE MONTHS ENDING DECEMBER 1906.			
	1905		1906		1905		1906	
	Quantity in lbs.	Value in Dollars.	Quantity in lbs.	Value in Dollars.	Quantity in lbs.	Value in Dollars.	Quantity in lbs.	Value in Dollars.
United Kingdom . .	61,780	\$ 618	25,713,600	\$121,959	13,591,180	\$ 43,250	185,976,264	590,839
Belgium	15,938,856	48,678	1,263,698	3,357	134,661,543	219,722	225,436,189	732,403
France	789,900	2,711	11,562,900	32,828	5,545,660	27,748	25,690,800	83,009
Germany	15,068,641	51,132	69,894,267	203,336	182,530,173	607,052	348,631,724	1,120,924
All Other Europe . .			546,200	3,624	240,659	609	19,908,053	60,212
British North Am. .	1,600	18			166,10	1,609	3,895,833	27,077
Other Countries . .	24,400	261	10,000	64	494,915	2,051	72,896,104	335,704
TOTAL	31,885,827	103,415	108,990,665	382,517	338,630,739	1,102,041	828,284,967	2,950,268
Domestic Exports of Cement, bbls. . .	70,591	96,745	33,608	53,803	1,016,226	1,387,706	583,229	944,886

There were 5,921,494 lbs. of imported Roman and Portland Cement, etc., in the United States bonded warehouses in December, 1905, valued at \$17,543, against 15,038,764 lbs. in December, 1906, valued at \$51,113.

For twelve months ending in December, 1905, there were 86,748 tons of asphaltum imported in the United States, valued at \$382,667, against 97,274 tons imported in twelve months ending December, 1906, valued at \$388,010.

HIGH EFFICIENCY TANTULUM LAMPS.

A new Tantulum filament incandescent lamp of high candle power and low consumption of power has been placed upon the market by Messrs. Siemens & Hulske of Berlin, Germany. During the development and perfection of this new lamp it gave such remarkable results that grave fear was entertained by the electric power companies that it would seriously cut down their business as the new lamp requires less than half the power required by the carbon fila-



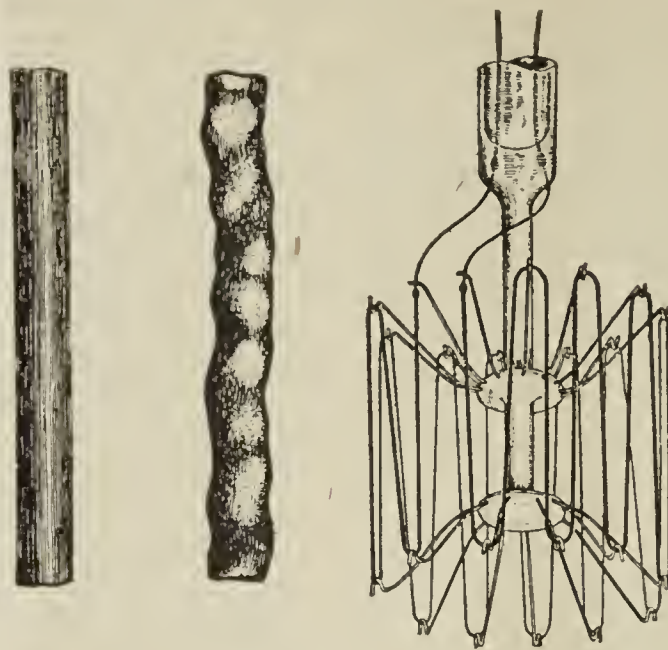
Full size 110 volt. lamp.

ment lamps now in general use. The old carbon filament lamps consume about $3\frac{1}{2}$ watts for each candle power produced while the new lamps require only $1\frac{1}{2}$ watts per candle power. This means that one-half or more of the fuel can be saved by the use of the Tantulum lamp, as on H. P. equalling 476 watts will produce only 228 candle power with the carbon filament lamp or about thirteen 16 candle power lamp per H. P., while the Tantulum lamp will produce 497 candle power per H. P. expended, that is to say a 25 candle power Tantulum lamp calls for only $37\frac{1}{2}$

watts or $18\frac{1}{2}$ watts less than a 16 candle power carbon filament lamp requires. Our illustration shows a full sized 25 candle power tantulum lamp with 26 inches of tantulum wire wound over the arms of a lower and upper spider carried on two glass disks mounted on a short glass rod, the two terminals are connected and carried down through the base of the lamp in the ordinary way. The tantulum wire used in these lamps is drawn so fine that one kilogram equaling 2 1-5 lbs. is sufficient to equip 45,000 lamps. The tantulum consumes 50 per cent less current at the same voltages with the same or greater intensity of light and the same useful life, its life is several times that of the carbon type. This lamp can be operated at 1 watt per candle power. This will give 746 candle power per horse power. At this rate the life of the lamp is shortened to fully two-thirds of its usual life.

Our illustration shows a tantulum filament before and after 1,000 hours' use magnified 100 times, while the new filament is perfectly smooth, the old lamp filament tends to contort and becomes deformed, showing drop or bead-like effect, and becomes slightly shortened. The filament and frame of a new lamp is likewise shown. That there is a great future for this new lamp there can be no reasonable doubt. Messrs. Siemens & Hulske are now erecting a larger factory for the manufacture of these lamps, the present output being limited and much too small for the large existing demand.

The Rock River Construction Co. has been incorporated. Its capital stock is \$25,000, and its object



Taitalum filament before and after 1,000 hours use.

Filament frame of new lamp.

is contracting and mercantile and manufacturing. Incorporators: Lambert Wannois, Leon L. Dewar and William Irwin.

COYNE BROS. TRADE SCHOOL OF BRICKLAYING, PLASTERING AND PLUMBING.

Trade unions have restricted the number of apprentices to such an extent that there are few opportunities for our young men to learn a trade. This is particularly true of the bricklayers', plasterers', and plumbing trades. At present we draw our supply of new workmen from late arrivals from Europe, therefore, our unions always under the influences of this class of workmen. It is gratifying to know that young men can now learn any of the three trades above named outside of labor union restrictions, and in a much shorter time than under the apprenticeship method. We refer to the Coyne Bros.' Company Trade School at Chicago, where young men are taught in a practical manner either of the three trades, bricklaying, plastering or plumbing. The student commence to handle tools at once instead of making himself useful as a roustabout in and about the shop or building in which he is employed. From two to three months makes a young man a capable mechanic at the Coyne Bros.' school, where some 250 are now under instructions. These students come from all parts of the country. American bricklayers, plasterers and plumbers are the highest paid mechanics in the world.

The Trade School catalogue will be mailed on request by addressing Coyne Bros. Co., 840-848 North Ashland avenue, Chicago, Ill.

FOR TURBINE USERS.

A paper entitled "Turbine Water Wheel Tests and Power Tables," written by Mr. Robert Horton of the United States Geological Survey will be of interest to manufacturers throughout the country. The paper is not intended, however, as a treatise on the turbine, and comprises no extensive discussion of its theory, design, or construction. It is mainly a compilation of data derived from tests and from manufacturers' power tables of American stock sizes of turbines. A bibliography has been added, giving selected references for the use of those who may wish to investigate the subject further.

The primary object of the paper has been to furnish information required in the work of the geological survey, where the turbine is used as a water meter in gaging streams. A secondary object has been to furnish information from which the power developed at mills can be determined from the sizes and types of water wheels used. Such information is often required in the census and other water-power canvasses. The water rights of mills can often be definitely determined only by the quantity of water used by the turbines which are or have been employed to develop the power. Some of these turbines are no longer built or catalogued, and it is believed that the manufacturers' rating tables and the record of tests of the older types of wheels will be serviceable to engineers who may be required to determine questions of water rights.

Many antiquated patterns of turbines are still on the market and a clear presentation of the evolution of the different types of turbine water wheels should be of practical service to those who wish to know the merits and demerits of the various styles. Much of the data has been presented in graphic form. It is believed that the section treating of the selection and arrangement of turbines in power plants will be of service to all turbine users.

This report, which is listed as Water-Supply and Irrigation Paper No. 180, is among the Survey's free publications.

The Eureka Machine company of Lansing, Mich., \$50,000 capital, has been organized to manufacture a cement mixer which has already had a large sale. Frederick Fisher is secretary and manager of the enterprise.

Nebraska State Association of Cement Users held its annual convention at Grand Island, Neb., about February 8th. One hundred members were in attendance, including machinery manufacturers. Ex-Governor Mickey was to be present, but was unable to attend owing to illness. Papers were read and discussed on "The Curing of Cement by Steam," "Blocks in General," and kindred subjects. Prof. O. V. P. Stout, civil engineer of the Nebraska State University, read a paper on "Re-enforced Concrete." Many machines are on exhibition.

Officers were elected as follows for the ensuing year: L. E. Porter of York, president; R. B. Smith of Lexington, first vice-president; W. F. Roney of Grand Island, second vice-president; I. E. Walenpaugh of Western, secretary and treasurer. Members of executive committee. Frank Burger of Hastings, D. M. Clock of South Omaha, S. R. Leprack of Lincoln, W. M. Megrew of Crete and Peter Palmer of Oakland.

SHIP LOADS OF BUILDING MATERIAL FOR SAN FRANCISCO.

Something like 75 to 85 vessels are now afloat with cargoes of building material for the rebuilding of San Francisco.

Cement and structural steel comprise the bulk of these cargoes. There are likewise large quantities of pressed brick, lime, terra cotta distributed among these cargoes, the tonnage of these vessels varies from 1,000 to 5,000 tons, with a total of about 300,000 tons.

These vessels come from all parts of the world. 20 vessels alone hale from Antwerp, loaded with cement, others from England, France, Norway, Japan, Italy, Germany, Australia. Vessels from our own Atlantic ports make up a portion of this large fleet.

Many contracts for large Reinforced concrete buildings have been let. As yet few buildings have commenced on account of the scarcity of cement and steel, the arrival of the fleet is therefore anxiously awaited, when San Francisco will witness the greatest area of building construction the world has ever seen.

San Francisco.

The new cement plant at Leeds, Ala., is now in operation. Mayor F. H. Lewis, chief engineer and general manager, has plans under way for enlarging the plant.

NATIONAL ASSOCIATION OF MANUFACTURERS.

This association is organized to promote the interest of all manufacturers large or small. The aim and object being to conserve and protect its members from the unjust demands of labor and capital, as well as to favor or oppose such legislation as may be wisest for the welfare of the country in general and its manufacturing interests in particular.

The association maintain a Law Department which promulgates free advice covering legal questions relating to state laws affecting corporate taxation, tax reports and other legal matters incident to commercial experience of the average manufacturer, free of all expense to its members, except in special cases. Advice on unjust freight charges, imposed on members are promptly given.

It maintains an official organ entitled "American Industries" which discusses the live questions of the day, such as export trade, inquiries for American goods by foreign buyers, trade and labor conditions.

"The American Trade Index" containing a list of members, with a brief description of their products, is published annually for distribution all over the world.

Its reports on schemes of all kinds are fair and fearlessly made. It furnishes lists of foreign business houses, importers and nominal rates.

Translations of letters from one language to another. Translations of catalogues at moderate cost. Gives foreign and domestic credit reports, shipping and forwarding of goods from manufacturer to customer through the International Freight Bureau, including the preparing of consular invoices at moderate flat charges. Its aim is to furnish information and assist the manufacturer in the purchase of raw material and the disposing of the manufactural products with all the safe guards required to attain these ends. Every manufacturer should subscribe to the "American Industries," even if they do not join the association.

Full information can be had by addressing

MARSHALL CUSHING, Sec'y.,
Mutual Association of Manufacturers, 179
Broadway, N. Y.

The Lehigh Portland Cement Co., of Allentown, Pa., filed notice in the Pennsylvania State Department of an increase in the capital stock of from \$3,794,850 to \$7,731,750.

PRESERVING STONE AND CONCRETE BY SULPHUR OR ITS METALLIC COMPOUND.

A patent has recently been taken out on the continent for the preservation of stone, concrete and cement by a new process, based upon the employment of sulphur, pure or compounded, with the metallic salts. A great many processes have been invented and placed upon the market previous to this, dealing with the preservation of stone and cement, and preventing the same from being affected by the destructive influences of the climate, especially from humid agencies, but it is claimed for the last patent that it will preserve these bodies from all other destructive agents. It may be noted that all the processes which have been previously introduced, can be placed in two distinct groups—namely—the first group or class—for covering the body under treatment with a coating or burnish which will preserve it from all external influences.

The second group of class—for impregnating the body under treatment with antiputrativ salts which will fill up the intercellular spaces, and thereby prevent all decomposition or alteration.

The first method has been considered insufficient when the blocks or pieces of stone, concrete or cement have been exposed to any mechanical action which is likely to injure the coating or burnish, because then the climatic action is just as likely to act upon the material, destroying it as if it had never been treated with any one of the chemical compounds. It has also been observed that when the body has been exposed to the action of certain acids or alkalies, which are likely to attack the coating, that this first method is then quite useless.

The second method is much more satisfactory, since, by reason of the fact that it fills up the spaces or pores, and penetrates the mass generally it forms a conjunction of very superior qualities. Notwithstanding this latter recommendation, this method also has its defects, because in the evaporation which necessarily follows, parts of the dissolved bodies which have been employed in the impregnation of the materials are re-dissolved and so-carried off, leaving spaces or pores which are apt to be attacked in the course of time by various climatic or atmospheric compounds.

The process which has recently been introduced tends to avoid these various disadvantages, as well as

to improve the material under treatment. Sulphur possesses very many advantages which contribute, in addition to the preservation of the stone or other matter, to give it a greater hardness and firmness. Its fusion temperature is about 115 degree C., or 240 degrees F., and the stone or concrete at this temperature does not alter, only losing the intermolecular water, which is replaced by the sulphur or sulphur compounds. The element—sulphur—also offers a perfect resistance to all humid action, as well as to the influences of acids, and when cold is attacked by very few of the alkalies, for which reason it is to be considered a very excellent substance for the purpose to which it is now being applied. Its low mechanical resistance and its great fragility have been the reasons why it has not been before user for the above purpose, but seeing that stone, whether natural or artificial, may be said to possess a number of qualities which sulphur lacks, it has been discovered that, when thoroughly impregnated, a resistance is formed, which, in practice, has been found to give very good results. The process which is being followed for impregnating the various bodies with sulphur consists in melting the latter in a vessel heated with steam and maintained at a temperature of 140 degrees C., or 284 degrees F. The material to be treated is then completely submerged in this bath, and when the water, which is contained in it is entirely evaporated, the sulphur is substituted, filling up, in this latter process, all the spaces or pores. At the commencement of the operation certain gases and some steam will be seen to be leaving the blocks or slabs under treatment, and when these gases have entirely ceased to come out of the blocks, the process is considered as completed. The materials are then taken out of the bath, and allowed to cool slowly, thereby causing the sulphur to become much harder than if it were cooled more rapidly.

It has been found practicable to add about ten per cent of sulphate of copper to the pure sulphur when dealing with bodies which are to be polished, but for sand stones and similar materials pure sulphur alone is more generally used. It must be noticed in conclusion, that the quantity of sulphur which is absorbed varies according to the temperature and duration of the bath, as well as to the quality of the stone, a soft stone or a coarse grained stone absorbing more than a close grained stone.

A NEW CEMENT PLANT.

D. A. Marks, president of the Continental Brick Company of St. Louis, Mo., announced that a contract had been entered into between the company and certain eastern cement manufacturers, giving the eastern capitalists the privilege of erecting a modern mill, with a capacity of 2,500 barrels of cement a day, on ground owned by the brick company four miles west of Carondelet, at the junction of the Missouri Pacific and the Frisco and Rock Island railways.

The proposed mill is to be one of the largest west of the Mississippi river and will involve the investment of about \$1,750,000 before it is completed. Work will be commenced as soon as the weather permits, and the contractors have promised its completion before the end of 1907.

Representatives of the eastern firm have been touring the west and middle west in search of a desirable location for a plant. When they viewed the ground of the Continental Brick Company they came to a quick decision, stating that St. Louis had advantages in manufacturing and distribution more than equal to those of any other point in the west or possibly in the entire United States.

The ground, which has been leased, consists of 150 acres near Shores switch, at the junction of the Missouri Pacific and the Frisco, and is lined with limestone deposits for a known depth of 150 feet. This furnishes a practically inexhaustible supply of material. The Continental Brick Company has skinned the clay for a depth of 9 feet or about twenty-five acres. The rich limestone is exposed in this tract, which is calculated to furnish material for at least fifty years.

The board of directors of the Continental Brick Company is composed of David A. Marks, president; Otto C. Oehler, secretary; George Beck, Henry C. Petring and George H. Petring.

THE POWER & MINING MACHINERY CO., MILWAUKEE, WIS.

Has published a handsome catalogue entitled Cement Making Machinery, covering 86 pages, 9 by 6 in width. Numerous illustrations of grinding Rolling Kilns, crushed cars, and other appliances used in manufacture of cement, including gas generating system installations.

STANDARD SAND FOR CEMENT WORK.

M. J. Reinhart, B. C. E., Ames, Iowa.

In taking up this subject of sands although with one principal fundamental object in view, I have worked along two somewhat different lines

In the first place, for a matter of comparison largely, or in other words to show what the very best sand should be like, I have attempted to form, by mechanically putting together the different graded particles, what might be regarded as a standard sand for cement users.

Secondly, I have attempted to determine and show how ordinary sands could be improved by screening or by the addition of the proper material to give the minimum amount of voids, and thus afford the maximum results at the least possible cost.

Before going farther I wish to state, however, that the time I have had in which to make this investigation has been very limited, and that the numerous experiments that well might have been made in working up such a subject had to be for the most part omitted, and while my mechanical mixtures have greatly decreased the amount of void and materially increased the strength of mortars made therefrom they may or may not be the best possible mixtures that can be made from such materials.

The sand I have used in this experiment is a bank sand taken from the college pit and is a sand of exceptionally good quality, containing but thirty per cent voids, while the ordinary run of Iowa sands contain from thirty to forty per cent voids. It is a comparatively coarse sand, and largely free from earthy materials.

To begin with all that failed to pass a No. 2 sieve was rejected. This was a very small per cent of the material, about three per cent, and it was the grades from this size down that were used in making the mixtures.

The screens used in separating the sand into the various sizes were as follows: The No. 2, or two meshes per lineal inch; the No. 4, or four meshes per lineal inch; the No. 8, No. 16, No. 30 and the No. 50 screens. With the above screens a given amount of material was divided into the six following graded sizes: that which passed the No. 2 and was retained on the No. 4; passed the No. 4 and was retained on the

No. 8; passed No. 8 and was retained on the No. 16; passed No. 16 and was retained on No. 30; passed No. 30 and retained on No. 50, and finally that which passed No. 50 sieve. In each case the per cent of the whole was determined by weight and the voids in each separate part determined.

ed. The vessel was then emptied and a certain amount of water poured in, approximately equal in volume to the voids in the sand. The sand was again carefully put back into the jar and water enough removed or added to cause it to stand just to the level of the line around the glass. The difference in weight be-

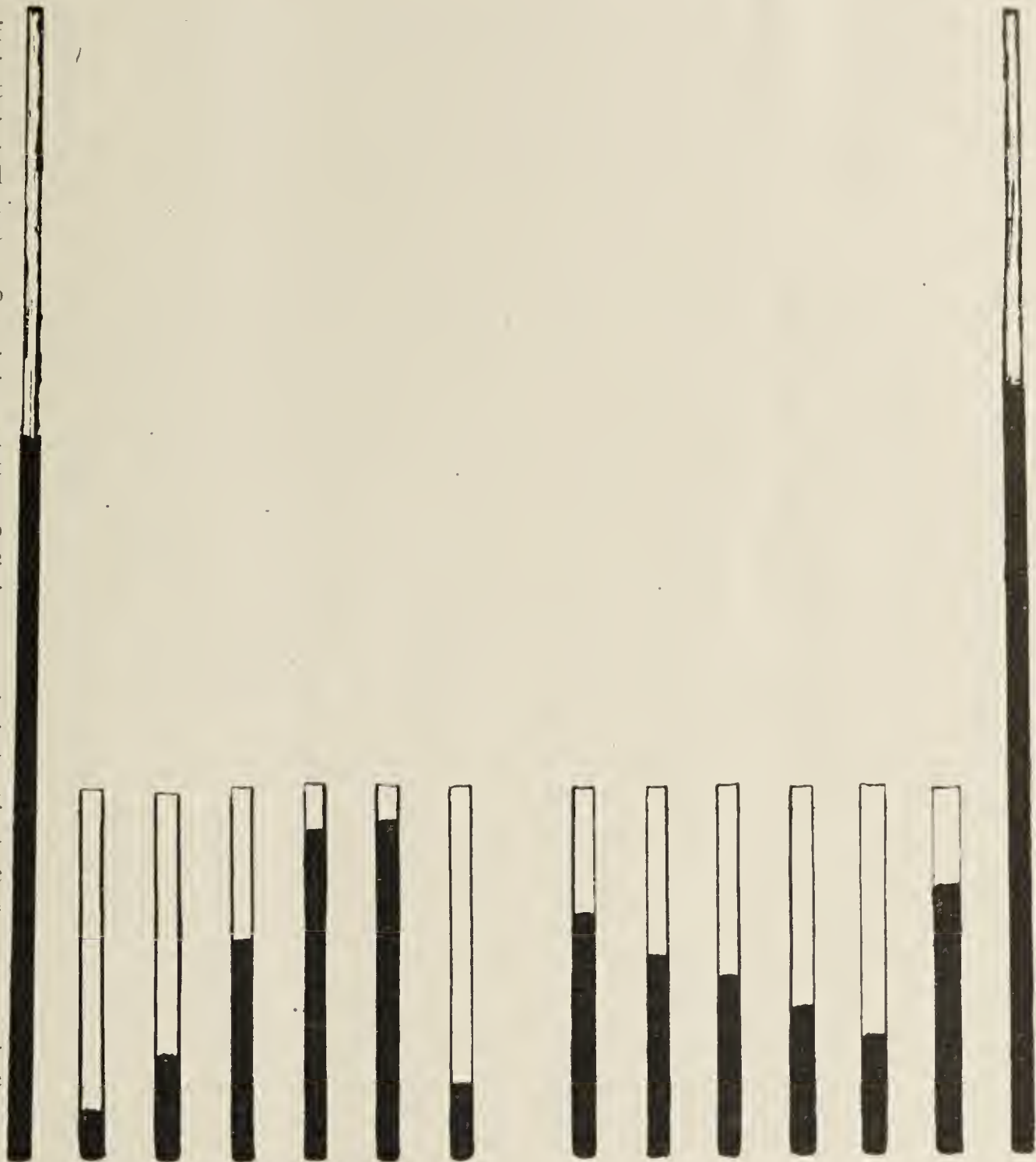


Fig. 1. Tubes containing the different sized grains of sand.

The above Fig. 1 shows the results of this separation; the height of sand in each short tube compared to the height in the long tube shows the proportional part by weight of that grade compared to the whole; the per cent of voids and the grade of material is marked over each tube.

In determining the voids the following method was used: A cylindrical vessel holding about a pint was filled with sand carefully placed in up to a horizontal line around the jar, and settled somewhat by shaking and tapping the sides of the vessel, but not tamped, and then weigh-

tween the vessel filled with sand and water, and the weight of the vessel and sand alone is the weight of the water required to fill the voids of the sand. Next the weight of the water required to fill the vessel up to the horizontal line was determined and by the following expression the per cent of voids was calculated:

Weight of Water Required to Fill the Voids.

In all cases two determinations were made and the average taken.

Next a properly graded sand was attempted by putting the right

amount of each grade of sand in the mixture. The weight of a certain amount of the coarsest material was found, and to it was added just

of this coarse material No. 16 the proper amount of natural sand to add in order to just fill the voids was calculated thus:

TABLE NO. 1

PROPERLY GRADED SAND.					
Kind		Per cent.	Quantity in Mixture		Per cent. of
Passed	Retained	Voids	Separate	Combined	Total
No. 2	No. 4	44.2	3 lb. 2 oz.		22.9
No. 4	No. 8	42.4	1 lb. 6.1 oz.		10.2
No. 2	No. 8	38.0		4 lb. 8.1 oz.	
No. 8	No. 16	43.4	1 lb. 11.4 oz.		12.6
No. 2	No. 16	33.5		6 lb. 3.5 oz.	
No. 16	No. 30	38.7	2 lb. 1.4 oz.		15.5
No. 2	No. 30	28.9		8 lb. 5 oz.	
No. 30	No. 50	38.1	2 lb. 6.4 oz.		17.6
No. 2	No. 50	26.9		10 lb. 11.4 oz.	
No. 50		35.5	2 lb. 14.1 oz.		21.2
No. 2		24.4		13 lb. 9.5 oz.	

enough of the next size to fill the voids. This gave a material made up of particles or pebbles which passed the half inch mesh screen and were retained on the eighth-inch sieve. The voids of the large size was 44.2 per cent; of the small size 42.4 per cent, and of the mixture 38.0 per cent. To the mixture was added enough of the third size to fill the voids, and so on down to the finest material which passed the No. 50 sieve. Table 1 shows the weight and voids of each material and mixture.

It will be observed that the final mixture contained 24.4 per cent voids, the original sand 30 per cent, a reduction in voids of nearly 19 per cent. This was the second mixture tried, the other by adding an excess of fine material each time gave a slightly larger per cent of voids. Fig. 1 shows the comparative amounts of the different grades of sand used. Here the makeup of the natural sand can be readily compared to that of the properly graded sand.

Next a mixture that would be practicable for improving sand was tried, one which by one screening of the sand the voids could be materially reduced.

It is a generally known fact that if to ordinary sand fine pebbles as an aggregate be added a stronger mortar can be made from the sand, if mixed in a given proportion, so it was decided to add to the ordinary sand a certain amount of aggregate which passed a No. 2 sieve and was retained on a No. 16 sieve. To determine the correct proportion to add a determination was made to find the per cent of aggregate larger than that which passed a No. 16 size as well as the voids of the aggregate.

It was found that 34 per cent stopped on the No. 16 screen and that this material had 34.2 per cent voids. Starting thus with a given amount

In other words, to 10 lbs. of sand was added 16 lbs. of the coarser material, and this mixture contained just 25 per cent voids, a reduction in voids of nearly 17 per cent.

By the same method of determination the proper amount of aggregate to add to any sand or gravel might be determined.

In order to show the comparative strengths of mortars made from the sands, the natural, the properly graded mixture, and the mixture improved by one screening only, tests have been made, both for tension

mixture of sand, and the fine material in the proper proportion to fill the voids in the larger aggregate. This was not a concrete but a mortar of about the consistency for cement blocks, tile, posts, etc. In the natural sand there was a deficiency of both the coarse and fine material, while in the other mechanical mixtures this fault had been largely overcome. The former mixed in a proportion of $\frac{1}{4}$ the cement was insufficient to fill the voids, while in the latter case it was just sufficient, and hence the results.

I realize that it is impossible to find in nature a sand that would compare to a mechanical mixture prepared in the laboratory, and that in the same pit or location in a stream from which sand is taken there might be considerable variation, but nevertheless, consider that it would be advantageous to the cement user to know how the sand he is using does compare with the properly graded sand. Again it often happens that any one of several different sands may be used with little or no difference in cost, and for these reasons to serve as somewhat of a guide in selecting the sands to use, I have prepared 200 samples of mechanically proportioned or stand-

TABLE NO. 2.

COMPARATIVE TESTS
NATURAL SAND

TENSILE STRENGTH				CRUSHING STRENGTH					
Briquet- te No.	Propor- tions	Age When Broken	Tensile Strength Pounds per sq. in.	Speci- men No.	Propor- tions	Size	Age When Crushed	Total Load	Crushing Strength Pounds per sq.in.
2	1-3	7 days	385	2	1-4	6x6x6 in.	7 days	68000	1889
2	1-3	7 days	360						
2	1-3	7 days	355						
2	1-3	3 mo.	Average 367	2	1-4	6x6x6 in.	3 mo.		
2	1-3	3 mo.							
2	1-3	1 yr.							
2	1-3	1 yr.		2	1-4	6x6x6 in.	1 yr.		
2	1-3	1 yr.							
SAND IMPROVED BY ONE SCREENING									
1	1-3	7 days	365	1	1-4	6x6x6 in.	7 days	94000	2611
1	1-3	7 days	410						
1	1-3	7 days	400						
1	1-3	3 mo.	Average 397	1	1-4	6x6x6 in.	3 mo.		
1	1-3	3 mo.							
1	1-3	3 mo.							
1	1-3	1 yr.		1	1-4	6x6x6 in.	1 yr.		
1	1-3	1 yr.							
1	1-3	1 yr.							
PROPERLY PROPORTIONED SAND									
3	1-3	7 days	410	3	1-4	6x6x6 in.	7 days	7000	2139
3	1-3	7 days	405						
3	1-3	7 days	395						
3	1-3	3 mo.	Average 403	3	1-4	6x6x6 in.	3 mo.		
3	1-3	3 mo.							
3	1-3	3 mo.							
3	1-3	1 yr.		3	1-4	6x6x6 in.	1 yr.		
3	1-3	1 yr.							
3	1-3	1 yr.							

and compression. The specimens tested were ordinary briquettes for tensile strength and 6" cubes for compressive strength. Table II shows the comparative strengths of the materials.

The results show the value of having the graded materials in a

ard sand for free distribution to the members at this convention.

On examination of these samples you will find that there is about the right amount of fine material to fill the voids in the coarser, and that is what we want. In few sands is there an excess of coarse material,

in most an excess of the fine, but wherever possible to find a sand which compares favorably with this one it is quite certain, that for cement work you have a sand that is not far wrong.

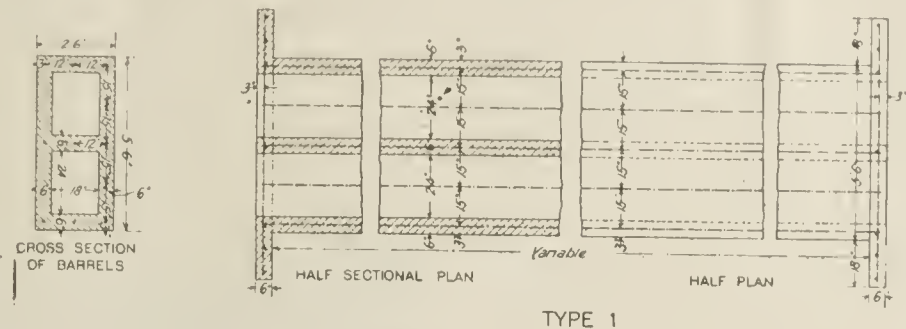
Taking up again the matter of actually improving sand to be used in work, it is easily seen that quite often this is not only possible but practicable. By a little study it is easy to tell how sands can be improved, by adding to or by rejecting certain grades of the mixture. For each busy cement products manufacturer to make a mechanical study of the sand he is using may be considered quite out of the question, but such a study is not necessary to obtain the desired results. Our engineering experiment station laboratory is here for your benefit, and you are cordially invited to send in sand for this purpose to be tested, for a limited time, free of charge. If by so testing and advising how to improve the sands used in the state, we can thus help to build up the cement products industry so that a stronger, denser, and better building material may result, then only will we feel that we have done our part.

U. S. RECLAMATION SERVICE—BUFORD-TRENTON PROJECT, N. D.

This project consists of the construction and completion of an irrigation system including ditches, canals, 420,000 cubic yards of earth excavation, 1 pumping station, 1,300 cubic yards of concrete and other materials. The pumping station will be erected in reinforced concrete, a section plan of which is shown in the illustration. The station will be 68'8" long by 20'8" wide. The concrete is divided into two

classes. Class 1, plain concrete; class 2, reinforced concrete. There will be 60 miles of canal in the distributing system. The water will be pumped from an intake on the Missouri river just south of Buford and distributed by means of earth canals, wooden flumes and 4 ft. re-

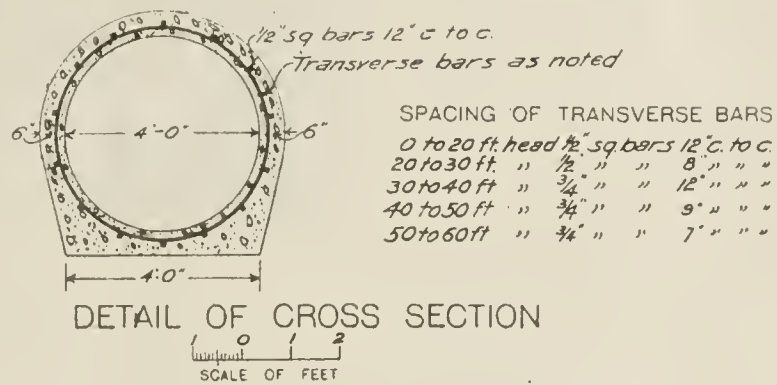
protected from the sun by covering with earth or other suitable material. This covering must be kept saturated with water until the back filling over the pipe is in place. If the concrete is mixed by machine, the mixing must be satisfactory to the engineer. If the machine fails



Reinforced Concrete Culverts.

inforced concrete pressure pipes. A cross section of the pressure pipe being shown with the size and spacing of bars used. The pressure pipe must be built in complete sections of such lengths as can be finished each day, the forms used and methods of construction must be satisfactory to the engineer. All forms filled with concrete must be

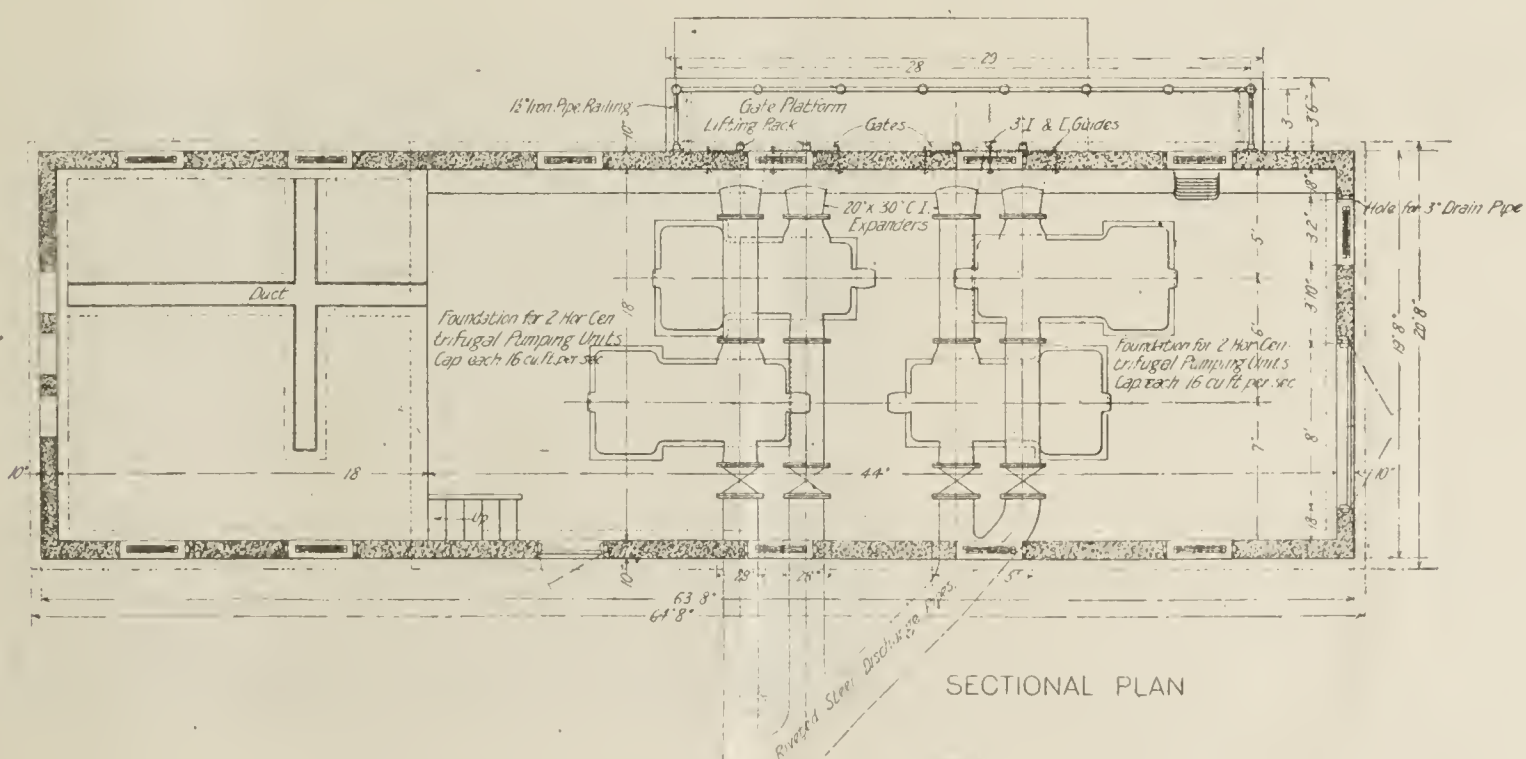
to mix satisfactorily, it must be removed and an other mixer substituted therefor. Where hand mixing is used, it shall be done in the following manner: A tight floor, either of plank or sheet iron must be used, the sand being first deposited on the floor with the cement in the required proportions, both must then be shoveled over as many times



Reinforced Concrete Pressure Pipes.

kept saturated with water and immediately after the removal of the forms all voids must be carefully filled with mortar, the inside of the pipe must be given two coats of cement grout applied with a brush. The outside of the pipe must be

as are necessary to make a thorough dry mix, sufficient water is added to make a stiff mortar and the mass shoveled over once or twice, the stone and gravel shall be wet before being added and the entire mass shoveled into the carriers. Only suf



Plan of Pumping station in Reinforced Concrete.

ficient concrete shall be mixed as will be used very soon after the mix is made. Any concrete that has acquired initial set before being used will be rejected and must be removed at once from the vicinity of the work.

The water used shall be reasonably clean and free from organic matter. All concrete shall be mixed and laid in the presence of an inspector and satisfactory to the engineer.

Forms and centers shall be smooth, line to shape and strong enough to stand the strain of ramming the concrete.

The reinforcement in the pressure pipes, the transverse bars, must be welded to form continuous rings. Reinforced culverts to pass drainage under the canal are shown in our illustration in half plan and cross section of barrels, the area to be irrigated includes 12,000 acres of land, the water being pumped from the river into a settling tank and from thence into two main distributing canals from whence the water is drawn off into lateral ditches, waste ditches, wooden and cement flumes. The contract for the work is to be let in March by the U. S. Reclamation Service, at Williston, N. Dakota.

THE JAMESTOWN CEMENT EXHIBIT.

The U. S. Geological department desires to have the larger display of the American cement industry than has been possible at previous expositions. With this end in view Mr. Edwin C. Eckel, the cement expert of the United States geological survey, was appointed commissioner in charge of cement exhibits. It is Mr. Eckel's intention to receive as comprehensive a set of exhibits as possible, dealing with all the phases of the industry. The exhibits will include a representative series of raw materials, with plans, photographs and models showing processes of manufacture, testing and utilization. An attempt will be made to give this exhibit an educational character by giving full data on the labels accompanying the various specimens. Cement literature, both in book and periodical form, will be shown, while the United States geological survey will exhibit maps and charts bearing on the industry. A considerable portion of the space allotted to this industry has already been taken by cement manufacturers and makers of concrete blocks.

REINFORCED CONCRETE SEWER AT ST. LOUIS.

The city of St. Louis has under way an extensive system of main trunk sewers to be in, constructed in reinforced concrete. The old style Johnson bars being used for reinforcing members. The work is known as the Harlem Creek Sewer,

29 ft. arch; 1,300 ft. of 27 ft. arch and 700 ft. of 29 ft. arch. A new contract for 2,600 feet of 25 ft. arch, a joint district sewer is under consideration 3 miles long with a 9 ft. arch. The sewer grade is $\frac{1}{4}$ per cent. with a total capacity of 4,400 cubic feet per second.

The concrete mixtures fall under two classes, A and B. Class A, used in the arch, is A1 $2\frac{1}{4}$ -4 $\frac{1}{2}$ mix-

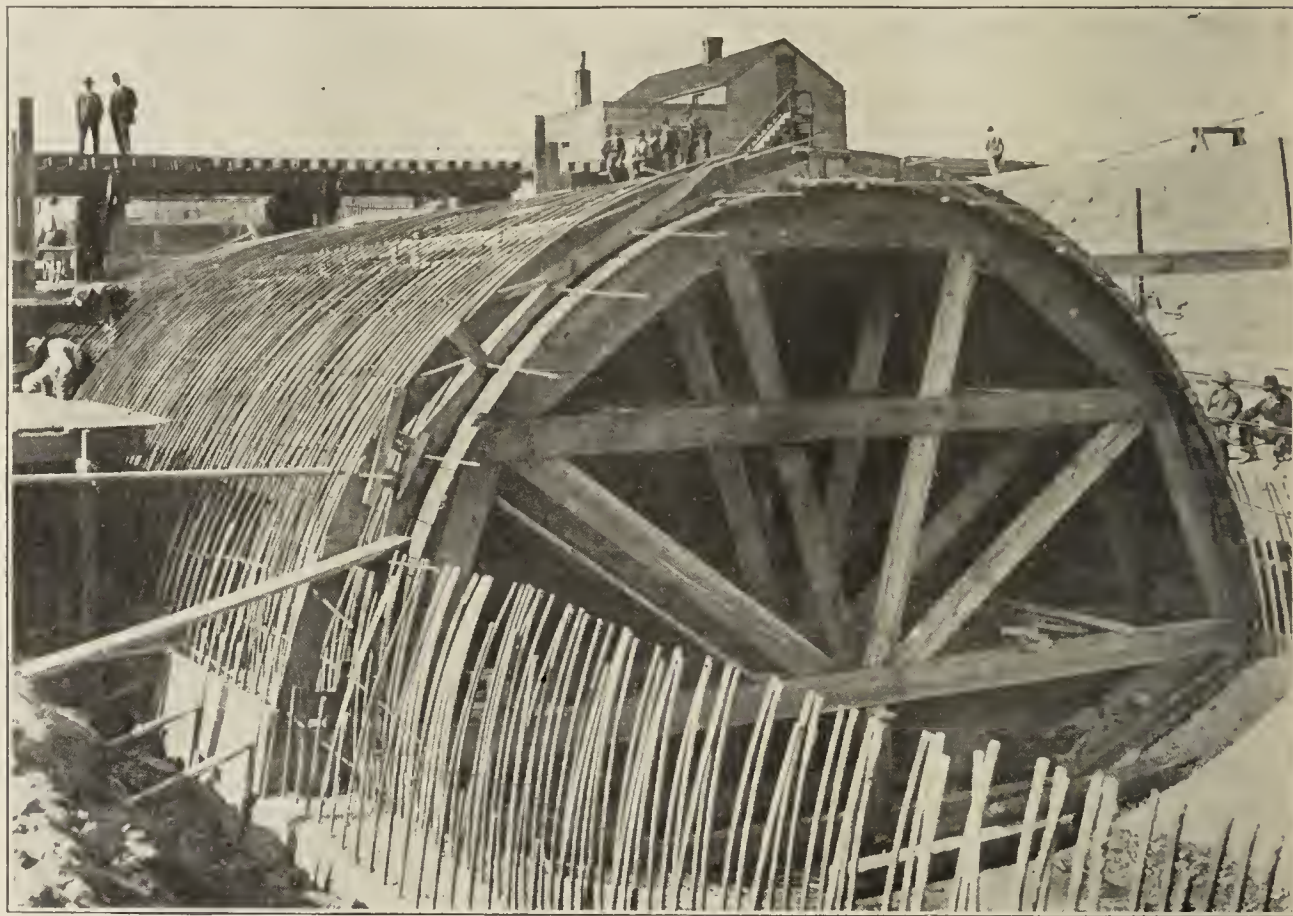


Fig. 1. Centering and Reinforcement, Harlem Creek Sewer.

which will extend from Bircher St. and Bulwer Ave. to Newsted and Dryden avenues and is designed to drain 3,106 acres. 1,723 acres lie on south branch of the creek and 1,183 acres on the north branch.

The sewers have 29, 27 and 25 ft. arches and inverts, one contract now under way covers 160 ft. of

ture. Class B, for the invert, is A1 $2\frac{1}{4}$ -5 $\frac{1}{2}$ mixture.

The Johnson bar reinforcement used in the work is placed as follows:

For the 25 ft. clear span with rock bottom and 30 ft. fill the schedule of bars is as follows: Extrados, two $\frac{3}{4}$ in. bars of 8 ft. length and

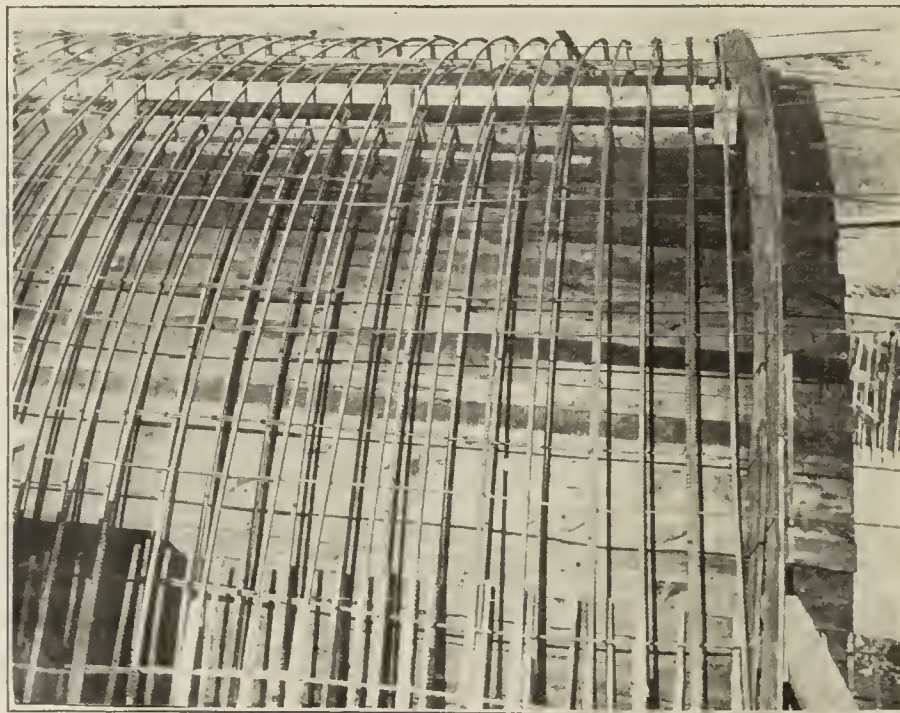


Fig. 2. Reinforcement-Tension and distributing rods, St. Louis sewer.

two $\frac{3}{4}$ in. bars of 20 ft. length; intrados, two $\frac{3}{4}$ in. bars of 6 ft. 4 in. length, two 1 in. bars of 6 ft. 4 in. length, one 1 in. bar of 14 ft. 4 in.

$\frac{3}{4}$ in. bars of 7 ft. length and two $\frac{3}{4}$ in. bars of 23 ft., $2\frac{3}{4}$ in. length; intrados, four $\frac{3}{4}$ in. bars of 9 ft. 3 in. length and one $\frac{3}{4}$ in. bar of 33

and earth bottoms and also for different amounts of fill.

The excavated rock is of a good quality, having a specific gravity of 2.65. This is used for the concrete and is crushed on the work. A cube mixer was employed for the concrete. Preliminary excavation was made by teams, after which a cable-way system was used.

The estimated quantities and the prices bid for the first contract are as follows: Earth excavation, 48,000 cu. yds. at \$0.50 per cu. yd.; rock excavation, 14,000 cu. yds. at \$1.50 per cu. yd.; concrete, 12,000 cu. yd. at \$8.00 per cu. yd. class A and \$7.00 per cu. yd. class B; steel, 1,400,000 lbs. at \$0.05 $\frac{1}{2}$ per ft. for bars weighing 2.70 lbs. and \$0.02 $\frac{1}{2}$ per ft. for bars weighing 0.85 lbs.; vitrified brick, 825 cu. yds. at \$10.00 per cu. yd.

The 25-ft. sections, shown in Figs. 3, 4, and 5, were designed by Messrs. Pritchard and Horner. The work is in charge of Mr. H. R. Fardwell, Sewer Commissioner; Mr. J. A. Hooke, Assistant Sewer Commissioner; and Mr. J. C. Pritchard, Engineer at the work. The Hoffman-Hogan Construction Company secured the first contract.

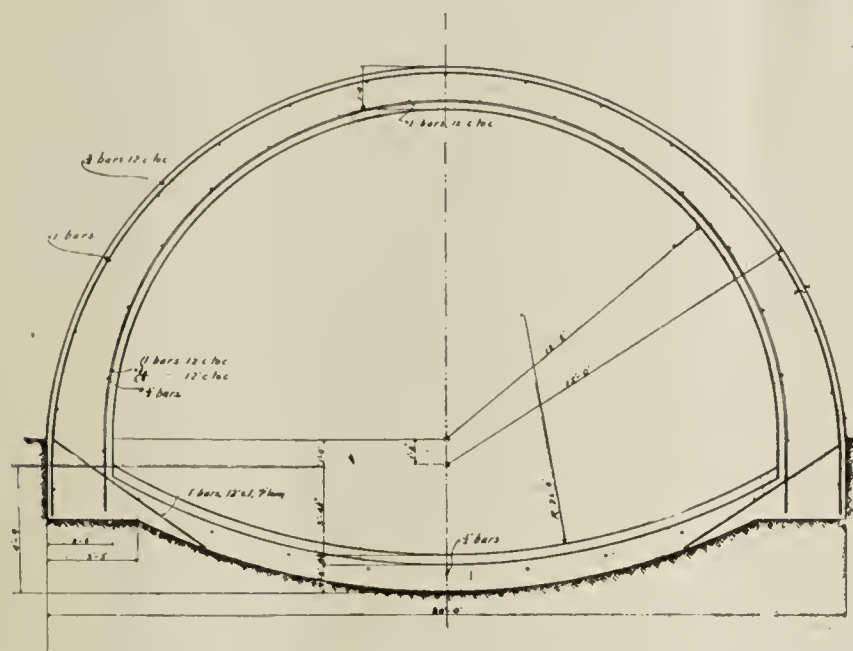


Fig. 3. Section of 25 ft. span sewer 21 ft. fill.

length and one 1 in. bar of 26 ft. 9 in. length; longitudinal, $\frac{1}{2}$ in. bars and two 1 in. bars of 7 ft. length. The bars are placed 12 ins. on centers with the exception of the longitudinal bars, which are placed as shown in Fig. 3. The lap of bars at splices is about 2 $\frac{1}{2}$ ft. The di-

ft. $\frac{1}{2}$ in. length; longitudinal, $\frac{1}{2}$ in. bars; one $\frac{3}{4}$ in. bar of 31 ft. 9 in. length. The bars are spaced as shown in Fig. 5.

The average rock cut is 5 ft., though in places the rock runs out. The average total cut is 25 ft. Sections were designed for both rock

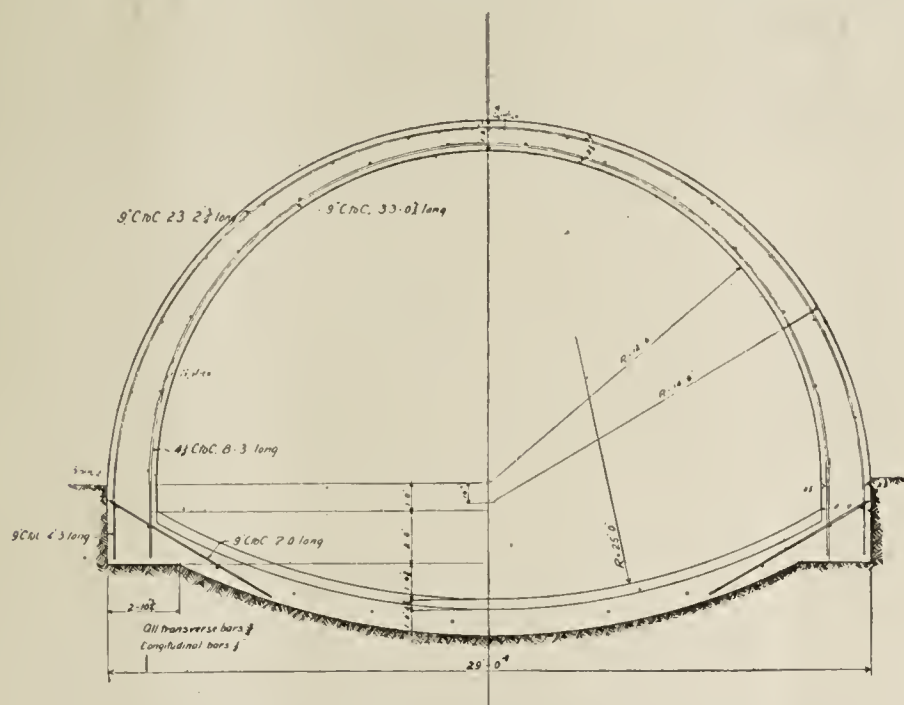


Fig. 4. Section of 25 ft. span, sewer 29 ft. over all.

mensions of the sewer are given in Fig. 3.

For the 25 ft. clear span, rock bottom and 20 ft. fill, the schedule of bars is as follows: Extrados, two $\frac{3}{4}$ in. bars of 4 ft. 3 in. length and two $\frac{3}{4}$ in. bars of 23 ft. $2\frac{3}{4}$ in. length; intrados, four $\frac{3}{4}$ in. bars of 8 ft. 3 in. length and one $\frac{3}{4}$ in. bar of 33 ft. $\frac{1}{2}$ in. length; longitudinal, $\frac{1}{2}$ in. bars; and two $\frac{3}{4}$ in. bars of 7 ft. length. The bars are placed as shown in Fig. 4, which also gives the dimensions of the arch.

For the 25 ft. clear span, soft bottom and 20 ft. fill, the schedule of bars is as follows: Extrados, two

Allentown, Pa., Feb. 16.—As Felix Sandys, a cementworker at the Lehigh Portland Cement Company's West Coplay plant, was broiling meat at the open door of a large rotary cement kiln last evening, a blast in a nearby quarry caused a great quantity of coal dust to fall from the rafters of the building. The coal dust, coming in contact with the open fire, caused an explosion, which roasted him alive.

The City of St. Paul laid 1,000,000 square feet of cement sidewalk block work and 10,000 square feet of cement walk built in place.

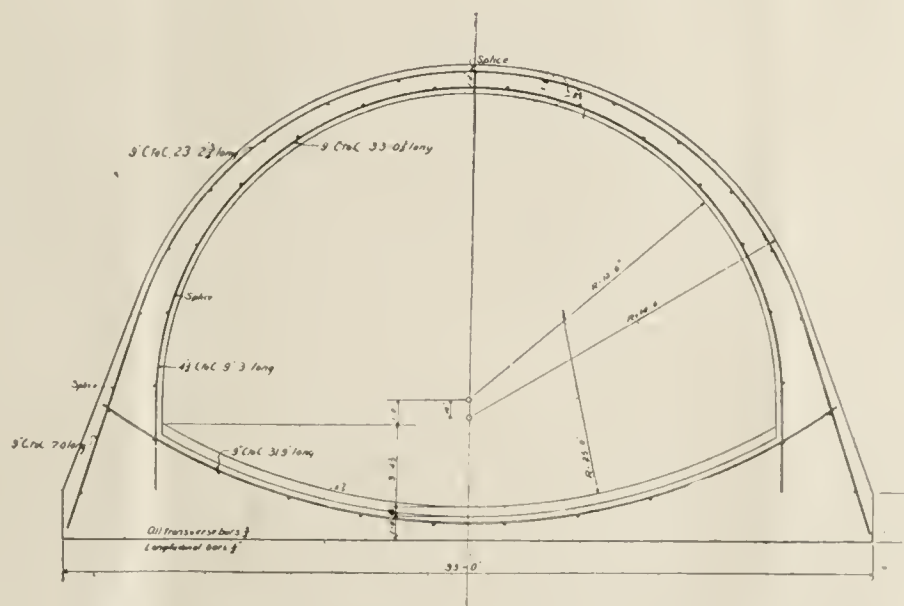


Fig. 5. Section of sewer 25 ft. clear span, 29 ft. over all.

Douglas H. Gordon and other altimore capitalists propose to erect a Portland cement mill near Bissell, on the Western Maryland Railway, the shale will be shipped from Williamsport, Pa. The rock deposits being located on the Kellar and Bradbly farms near Bissell. The first unit to be erected is to cost \$200,000, to which additions are to be made from time to time.

INSPECTING CEMENT TELEGRAPH POLES.

Officers of the telegraph and operating department of the Pennsylvania Railway Co. and the Western Union Telegraph department paid a visit to Rochester, Pa., for the purpose of inspecting and testing reinforced concrete telegraph poles at the test yards of the railway company at Rochester. The Pennsylvania Company was represented by Mr. Keller, superintendent of telegraphs. The chief engineer of maintenance of way, Mr. Cushing, chief line repairman, Mr. Dornberg and superintendent of construction, D. R. Davis, of Chicago, representing the Western Union Telegraph Company. These people will make a report on cement telegraph poles in the near future.

A UNIQUE STREET PAVEMENT.

The city of Monterey, California has a street paved with the backbone of whales, the seyments of the vertebrae were used as we use stone for street paving. The history connected with this pavement relates that about one hundred years ago a large school of whales were driven ashore and perished, after the flesh had decayed the backbones of these whales were used for paving the streets in place of large sea shells, which are frequently used for the same purpose, the streets in the old Spanish towns of California often served for man and beast, there being no sidewalks.

Mr. Geo. A. Benton, late of Holmes & Benton of Detroit, who promoted the Michigan Portland Cement Co., with a plant at Coldwater and Quincy, Mich., and the Iola Portland Cement Company, is looking into the cement materials in southern Ohio. Mr. Benton is now from N. Y. City and has been in the mining industry for several years, which business has been placed under the management of other parties to leave Mr. Benton free to do some promoting in the cement industry.

The new Frisco Railway freight depot at Springfield, Mo., 600 feet long, will be built of cement, up to the first story. Jordan Creek, which flows through the building site, will be covered with concrete arches 22 feet span, below the general floor level.

COST OF MAKING CEMENT AT THE GOVERNMENT PLANT IN ARIZONA.

The following table, showing the itemized cost of producing Portland cement at the Roosevelt dam, Arizona:

Tonto Portland Cement Mill Unit Costs.

	Oct.	Nov.
Salaries and labor....	\$0.75	\$0.70
Maintenance material..	.14	.15
Quarry explosives	.015	.02
Clay digging	.03	.03
Clay hauling	.08	.07
Miscellaneous supplies..	.05	.04
Miscellaneous labor and materials	.01	.01
Fuel wood	.01	.00
Fuel oil	.89	.89
Electric power	.15	.20
Total	\$2.125	\$2.13

The capacity of the mill exceeds the consumption as one is to four, that is one month's run will produce enough cement to keep the cotton supplied for three months after mill has shut down.

INCORPORATED.

W. A. and P. B. Heather of Silver City, New Mexico, have organized a cement building block company.

The Cincinnati Cement and Concrete company, \$10,000; W. E. Smith, Jay Brown, J. B. Pugh, Wm. A. Stone and M. Milo Beatty.

Rock River Concrete Construction Company, Oregon, Mo.; capital, \$25,000; contracting, mercantile and manufacturing. Incorporators—Lambertus Wanolts, Leon H. Dewar, William Irwin.

The J. L. Fortado company, Springfield, Ill.; capital, \$2,500; deal and contract in stone, cement and brick; incorporators, J. L. Fortado, E. F. Lomelino, John A. Barber.

The U. S. Portland Cement Co. of which owns 360 acres of land near Portland, Colorado, upon which a cement mill is to be erected in the near future. The plant is to have a capacity of 500 barrels per day.

J. R. Patterson and others of Union City, Michigan, have purchased 253 acres of land northwest

of Louisiana, Mo., for \$20,000 upon which they held options which expire April 1st, 1907, upon which a cement plant is to be erected in the near future.

The Virginia Portland Cement Co. is reported to have purchased the cement works near Montreal, Canada. The new owners will establish a second plant with a capacity of 6,000 barrels a day, investing for this fully \$2,000,000.

Oregon State Agricultural College is installing cement testing machinery for the purpose of testing cement and cement raw materials. The college will make tests of lime stone and clay without charge and give instructions for the people compounding raw materials. Prof. John Fulton of the department says, that Oregon should manufacture its own cement in the near future.

The Virginia Mining and Manufacturing Co. recently organized at Bristol, Tenn., proposes to build a Portland cement plant near Benhams, Washington County, Virginia. Capital \$75,000. Pittsburg, Pa., capitalists are in the deal.

Mr. Whitney Newton, vice-president and general manager of the Colorado Portland Cement Co., says his plant will produce 800,000 barrels of cement during the year. Most of which is shipped out of the state. Colorado proper does not consume more than 250,000 barrels per annum and that the new plant now under construction in Utah, Montana, California, Wyoming, Dakota, Idaho, Washington and Oregon will close the markets to the Colorado production in the near future.

PRODUCTION OF CEMENT IN MICHIGAN IN 1906.

State Labor Commissioner McLeod estimates that 4,032,418 barrels of Portland cement were manufactured in Michigan in 1906, an increase of 1,527,108 barrels over the production of 1905. There are fifteen plants in operation in the state, each having an average daily capacity of 1,280 barrels. A little over half the product is sold in Michigan.

There is material in sight for the operation of the plants 100 years, it is reported. Some of the factories, however, are obliged to secure clay, which is used with marl and limestone, out of the state.

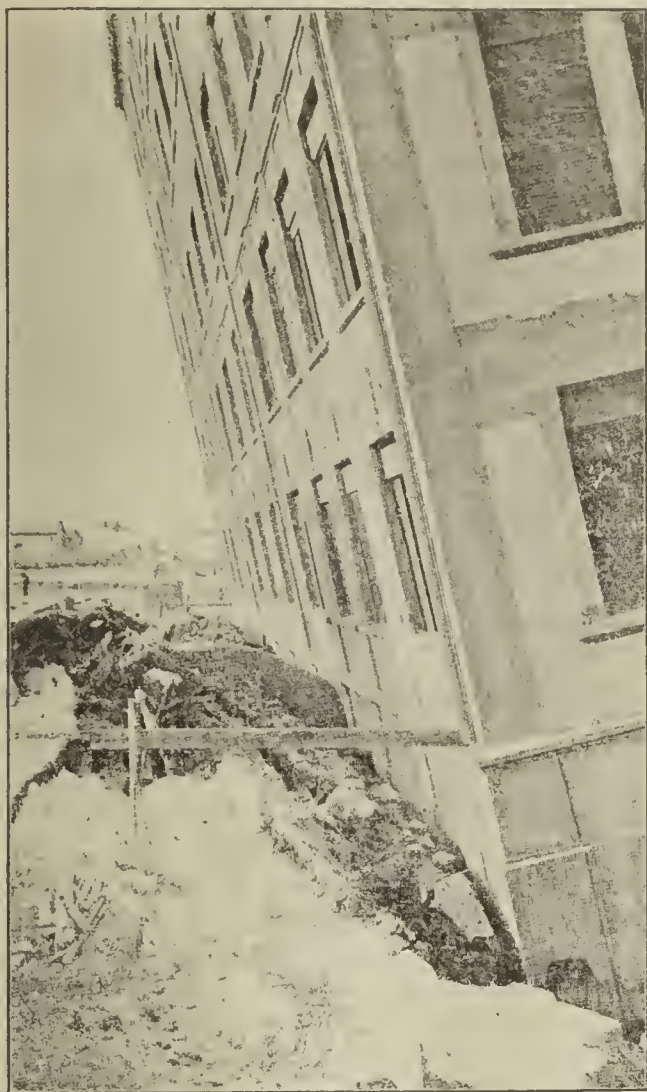
The factories provide work for 2,087 laborers, whose average daily wage is \$2.41.

UNEVEN SETTLING OF REINFORCED CONCRETE BUILDING AT TUNIS, AFRICA.

Three Reinforced concrete buildings were erected on marshy ground in the French portion of the city of

in charge began to load the high side of basement and ground floor with 4,000 tons of sand in bags on each floor, and 2,000 tons each on the upper floors, at the same time earth under the high side of the foundations was excavated to per-

capacity of the soil as well as to produce a uniform settlement of the structure should any take place. After 15,000 tons of ballast had been spread over the floor a settlement and canting from the vertical began to take place and in 17 hours there-



16 ft. displacement from the Vertical.



16 ft. displacement from the Vertical.

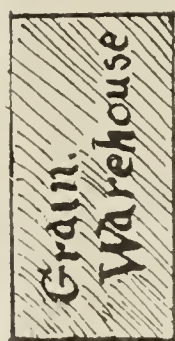
Tunis, Northern Africa. These buildings were designed for the storage of flour and grain for a flour mill as shown by the ground plan. Before the three structures were fin-

ished the grain storage warehouse began to gradually settle and cant over to one side and slightly backward and away from the mill building without showing any cracks or other defects in the concrete. The engineer

mit the building to right itself. The loading of the floors and excavations required about two weeks, after which the structure resumed its vertical position. Setting, however, after the building was 16 feet out of plumb, while the mill building remained perfectly stable. The ballast was then shifted to the high side on each floor and excavations were



Being Restored to the Vertical.



44'6"



← 112'1" →



44'7'3"

Ground Plan.

ished the grain storage warehouse began to gradually settle and cant over to one side and slightly backward and away from the mill building without showing any cracks or other defects in the concrete. The engineer

some 15 to 18 feet lower than before the settlement had commenced. The flour warehouse was completed about four months after settlement of the grain warehouse occurred. The engineers began to load the floors in order to test the carrying

made under the foundation as in the previous case, when the structure came back to its former position excepting that the entire building has settled over 15 feet below its former elevation.

PORTLAND CEMENT MATERIAL NEAR CHEYENNE, WYO.

A recent report entitled "Portland Cement Material in Eastern Wyoming," by Mr. Sydney H. Ball of the geological survey, states that Portland cement can probably be made in that district at a cost below the present local prices of eastern brands. Raw materials suitable for its manufacture were located by him last summer in the vicinity of both Newcastle and Cheyenne.

The rocks sampled in the vicinity of Iron Mountain which is about 40 miles from Cheyenne, include limestones from the Niobrara formation and the Minnekahta limestone, and shales from the Graneros formation, and the Pierre shale.

The best limestone sample is from a hill of Niobrara which lies east of the end of the Bradley Spur. It lies practically on edge and could be cheaply quarried, possibly by the use of steam shovels, although considerable blasting would probably be necessary as depth was acquired. Analysis shows that it contains 6.44 per cent silica, 1.46 per cent alumina, 2.32 per cent ferric oxide, 45.90 per cent lime, and 2.65 per cent magnesia. This is a good limestone for cement making purposes, although the relation between silica and combined alumina and ferric oxide is low. The Minnekahta limestone, which is found here in abundance, is much poorer in quality than the Niobrara, as it is high in silica and comparatively low in alumina and ferric oxide.

At the end of the railroad spur at Bradley Station 140 feet of shale of the Graneros formation is exposed. It runs 63.60 per cent silica, 14.66 per cent alumina, 7.44 per cent ferric oxide, .46 per cent magnesia, and 2.16 per cent in alkalis. This is a normal shale of which the silica is high and the ratio between alumina and ferric oxide and silica is ideal. The magnesia and the alkalis are each very low while there is sufficient iron present to insure a fusible cement matrix. The Pierre shale, which was sampled on the west side of the railroad track three-quarters of a mile northwest of Bradley Station, is of fair quality but not so good as the Graneros shale.

Gypsum is reported to occur in the "red beds" to the south of Iron Mountain.

A Portland cement plant at Iron Mountain should use for its raw materials the Graneros shale at the end of the Bradley spur and the Niobrara shaly limestone to the east of the same point. An extension of

the Bradley spur one-quarter of a mile long would connect the two deposits. Chugwater Creek furnishes sufficient water for a plant. Coal at Cheyenne is from \$4 to \$5 a ton. It is possible, however, that coal coming over the Colorado and Northern Railroad from the north would be cheaper.

Persons interested in the subject may learn more about it by reading Mr. Ball's report, which will be published in the forthcoming annual "Contributions to Economic Geology, 1906."

PORTLAND CEMENT AND CONCRETE IS PROTECTIVES OF STRUCTURAL STEEL.

Some valuable conclusions regarding the preventive and protective qualities of Portland cement and concrete have been arrived at by Frank R. Gilbreth, the New York contractor. Mr. Gilbreth, who is occupying an important position in the reconstruction of San Francisco, is reconstructing the 8-story Mutual Life building, the six upper stories of which were so severely damaged by the conflagration following the earthquake of April 18, 1906, that they had to be removed.

In the course of this work Mr. Gilbreth had the exceptional opportunity of noting the condition of the steel frame of a building erected thirteen years ago, and as a result of his study, he finds:

1. Portland cement is better than lime mortar for imbedding steel to prevent it from rusting.

2. Unpainted iron rods buried in mortar composed of lime and a large proportion of Portland cement rust very little, certainly not enough to impair their strength.

3. Columns should be of such cross section that they can be thoroughly imbedded in Portland cement, avoiding a hollow column unless laced and filled with very soft concrete.

4. Wherever possible preference should be given to those shapes of steel that present the least surface to the action of rust.

5. It is much easier to cover steel thoroughly with concrete than with brick masonry. If brick masonry is to be used the bricklayer should thoroughly plaster the steel work ahead of the brick work.

6. Cinder concrete does not injure to the slightest degree a steel floor beam that has been painted.

7. Terra cotta blocks are not as good as concrete for fire-proofing interior columns, nor do they protect the steel from rusting as well as does Portland cement concrete.

A CEMENT WAR TO BE WAGED.

Indications that a cement war has broken out among the biggest manufacturers in the state of California, with the business of San Francisco as the bone of contention, have been numerous recently, and a belligerent movement was made on Feb. 23, when the Standard Portland Cement Company, better known as "The Cement Trust," increased the capital of its California corporation from \$2,000,000 to \$4,000,000.

This is believed to be the result of the activity of the Henry Cowell Lime and Cement Company, which recently closed a contract with the Allis-Chalmers Company, of Milwaukee, Wis., for all the cement machinery and electrical equipment necessary for a complete modern cement mill of immense capacity. This company has heretofore manufactured lime only, but now intends to take in the cement business, which affords unbounded possibilities in San Francisco.

Hundreds of high-class buildings in which concrete is largely used are being erected, and the work is being delayed by the prevailing scarcity of cement. Those who are best acquainted with conditions do not look for the serious cutting of prices because of the fact that the future products of the California plants have already been sold far in advance of their manufacture.

The incorporation of the Standard Portland Cement Company in San Francisco was conducted by Garrett McEnerney, who said that the move meant simply the forming of a new corporation to take over the old one, by giving the stockholders two shares of the new for one of the old. The increase of \$2,000,000 in the capital was made necessary by the proposed extension of operations.

For more than a year the new plant, with a capacity of several thousand barrels per day, has been in course of construction at Santa Cruz, and it is expected that this will be running in full blast within 60 days at the farthest.

The personnel of the directory and management of the company will not be changed. War may be confidently expected, when the Cowell Lime and Cement corporation actively enters the field as competitors in the manufacture of cement. This will be of great advantage to the consumers as it will increase the supply and promises to bring a reduction in the prices.

MERGER OF CEMENT PLANTS.

The Iola Portland Cement Company and the St. Louis Portland Cement Company have been merged into a single holding company, with George E. Nicholson as president. Sheldon H. Bassett, first vice-president; J. A. Lewis, second vice-president, and J. W. Perry, secretary and treasurer, with head office at St. Louis.

A BIG CEMENT COMPANY FORMED.

The Standard Cement Corporation has just been organized in San Francisco to manufacture cement, own real property, acquire franchises, operate quarries, acquire water sources, charter vessels and sell electricity. The capital stock is \$4,000,000. An extensive search will be made all over the state for new cement fields, and the newly formed corporation will seek to meet the vast demand for cement created by the immense rush of new buildings going up in San Francisco and other parts of California. The Board of Directors are: James L. E. Robinson, Walter Rothchild, Thomas D. Davidson, Joseph H. Mayer, and Andrew F. Burke. This is one of the largest cement corporations in California.

D. A. Marks, president of the Consolidated Brick Company, of St. Louis, Mo., announced that eastern capitalists proposed investing \$1,500,000 in a cement plant at Shore's Switch, about four miles west of Carondelet, at the junction of the Iron Mountain and the Frisco roads. An option has been secured on 150 acres of property at this point.

Mr. Theodore Weisberger of Yakima, Wash., has received the contract for the cement work for The Tieton canal from the Secretary of the Interior, the contract being for \$272,000.

SELF-PROPELLED VEHICLES.

A Practical Treatise on all forms of automobiles, by James E. Homans, A. M. Published by Theo. Audel & Co., 63 Fifth Ave., N. Y.

This treatise covers 598 pages and 399 illustrations. The book fulfills the requirements of the motor vehicle owner, operator and repairer. It should be in the hands of all persons interested in automobiles who desire to familiarize themselves with their operation and construction.

The Central Portland Cement Co. is to erect a plant four miles east of Elk City, Kan. J. A. McEntee, general manager, now in Kansas City, says the contract for the plant has been let to the Osborne Engineering Co., of Cleveland, Ohio. Workmen have been clearing up the site for a large reservoir.

The Union City Lumber Co., of Grand Rapids, Mich., are reported to be considering the erection of a Portland cement mill in Menifee County, Kentucky, all preliminary investigations of materials have been made and are satisfactory.

The citizens of Springfield, Ill., have entered numerous complaints against the slippery condition of the cement walk on account of the numerous falls received by people walking over them and especially where there is considerable down grade.

Death Valley, Quyo County, California, is the lowest point of dryland in the United States. The lowest point being 276 feet below sea level, while Mt. Whitney in Fulton County, 75 miles from Death Valley, is the highest point of land in the country.

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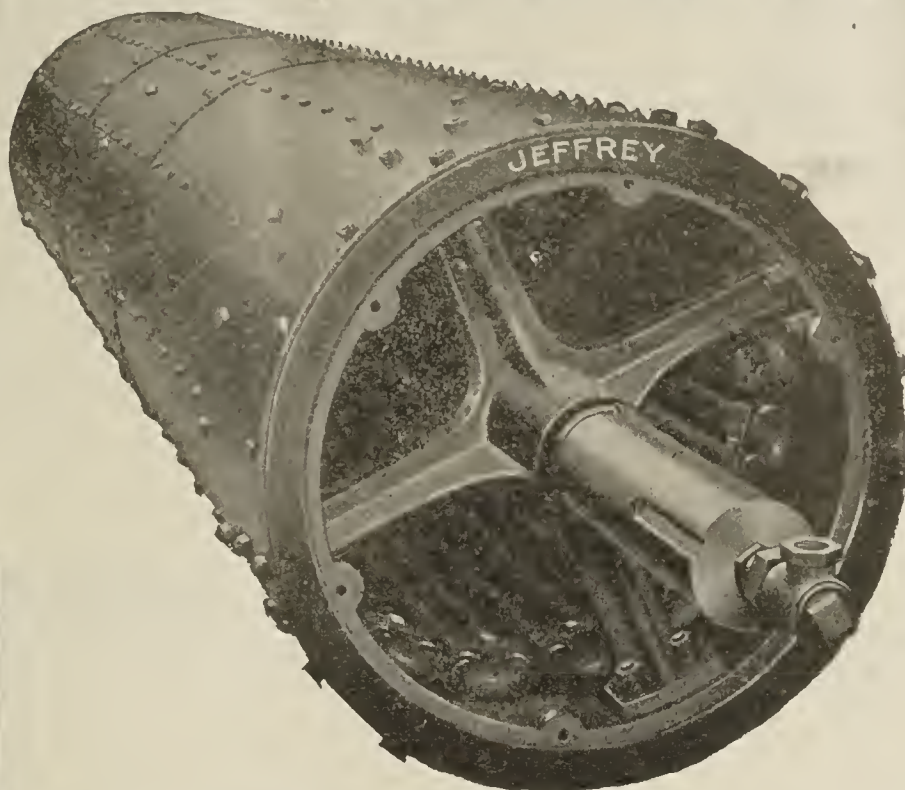
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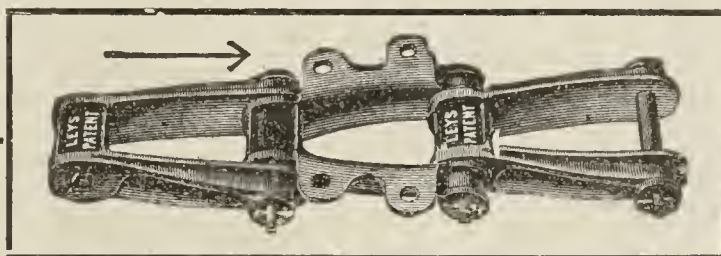
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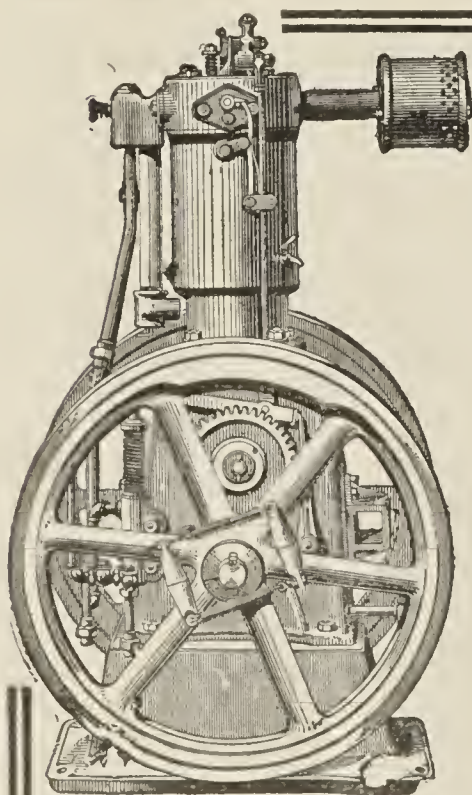
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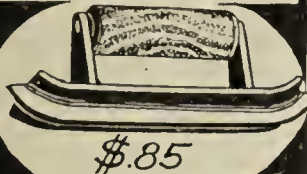
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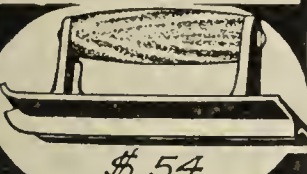
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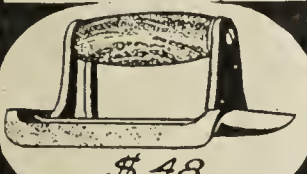
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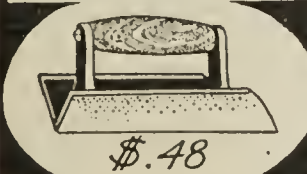
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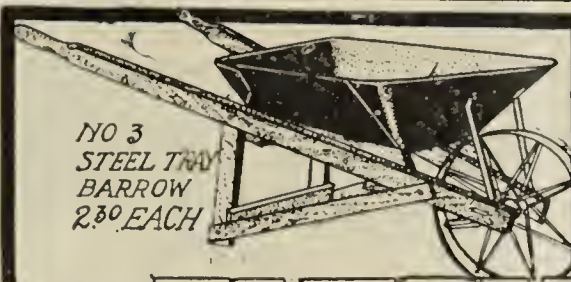
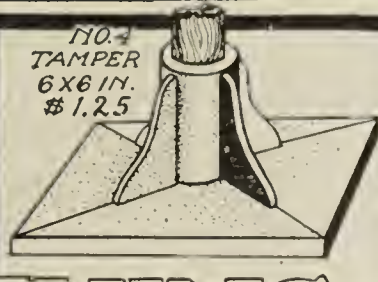


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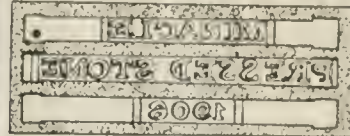
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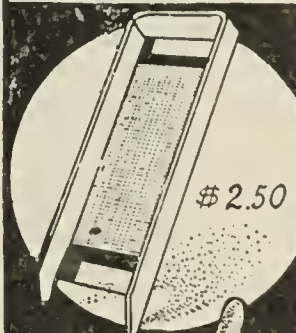
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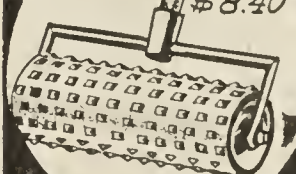
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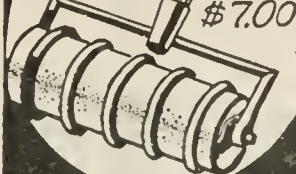
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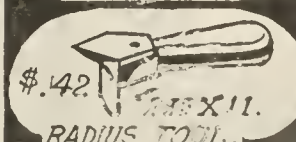
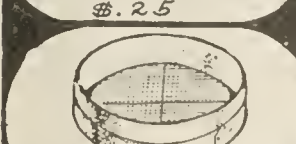
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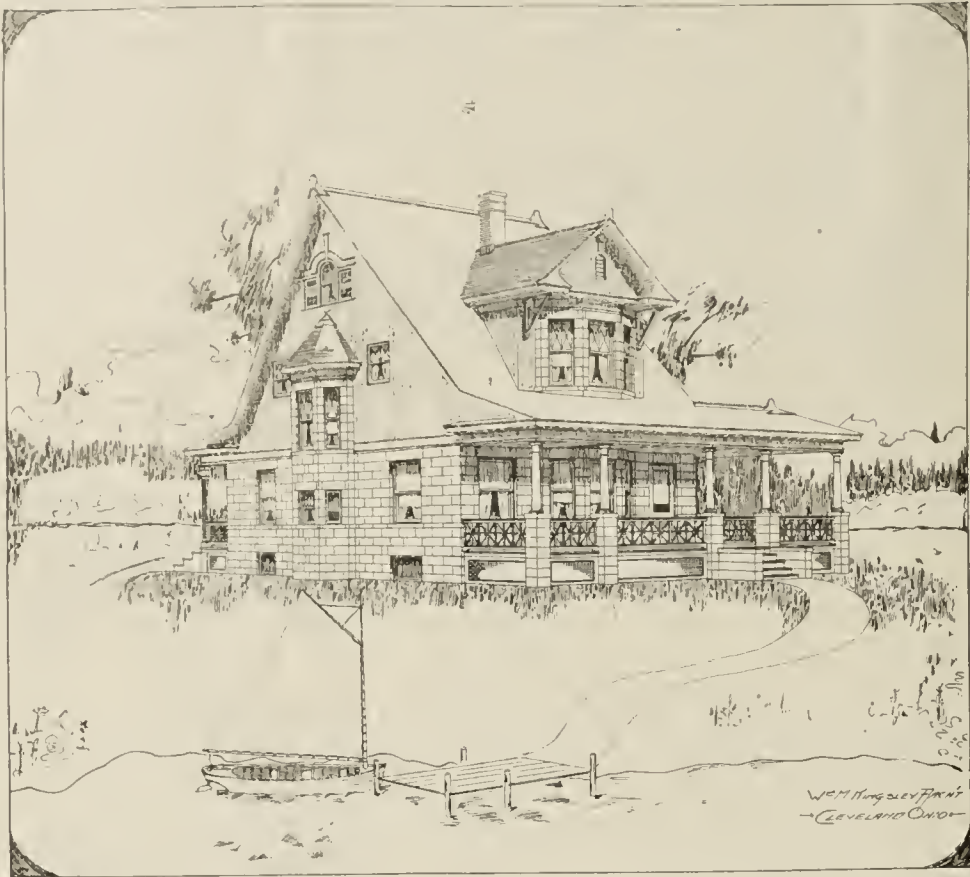
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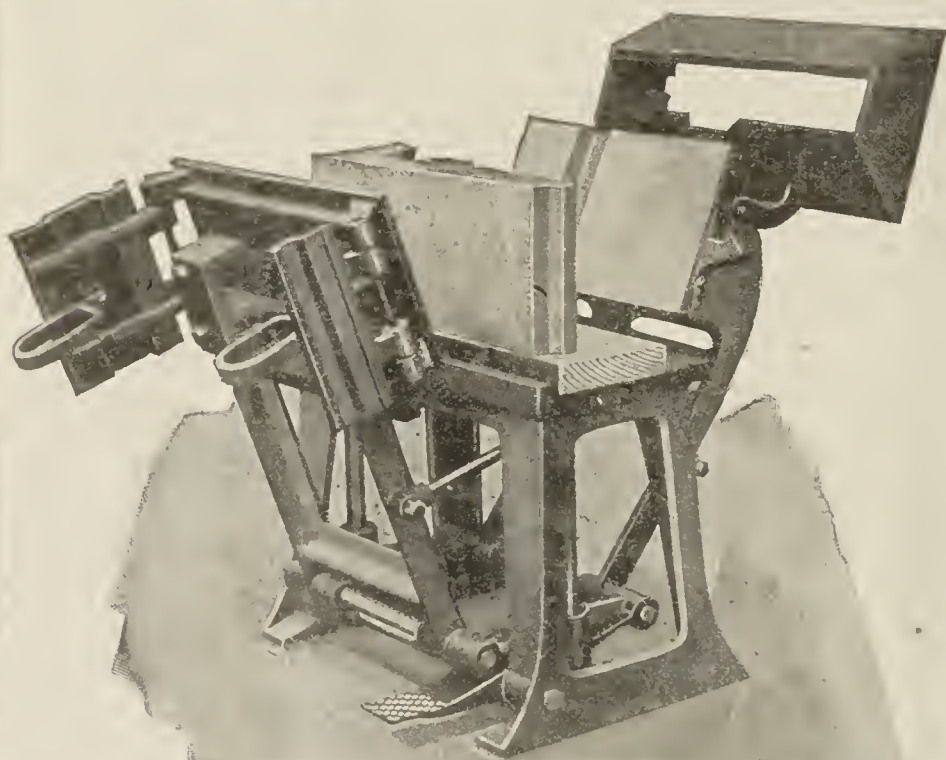
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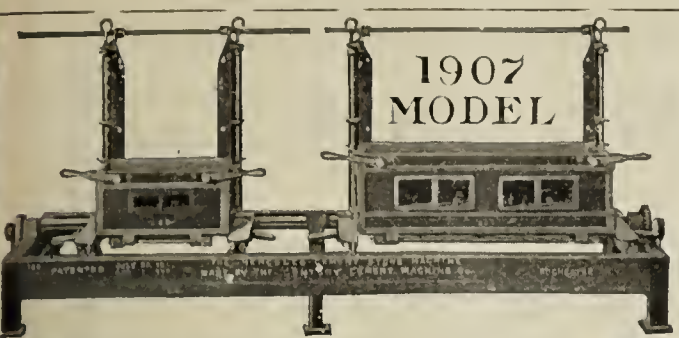
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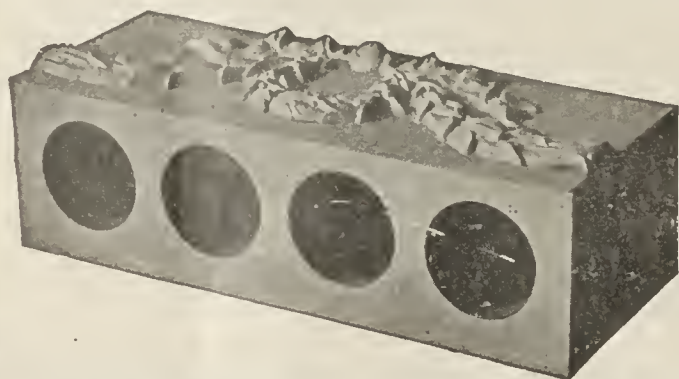
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Cement.—See page 69 for description.

CEMENT AND ENGINEERING NEWS

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"This world belongs to the energetic"

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CORRESPONDENCE.

We solicit correspondence on all matters of general interest to the cement trade in all its branches. Engineering notes, public improvements, and facts and opinions drawn from practical experiments will be welcome.

EXTERNAL CEMENT FINISH FOR FIRST CLASS BUILDINGS.

Heretofore it has been the common practice to veneer first class concrete buildings with either brick or stone, in order to hide the concrete, which was deemed incapable of receiving an artistic finish, hence it was covered over with brick or stone. This has been due to the prejudice of individual architects who imagined that concrete was out of place in anything but foundation work where it would be out of sight. Now a great change is taking place in this respect, particularly in large buildings in our large cities, and especially so in Chicago where buildings are being overhauled in the downtown district. A marble front was taken down by the Union Restaurant & Hotel building and replaced with concrete. This particular front is clean, neat and artistic, and is admired by all who see it. Several other restaurant fronts have been taken down and rebuilt in highly ornamental concrete, which could not be duplicated in stone at ten times the cost. The designs for these fronts are made on paper by the architect and carried out by the sculptures who made the mold. The concrete is then made in sections and erected in place. One mold at times answers for one-half of the front by duplicating the pattern. The ornamental parts

are made in the factory, and brought to the work where it is set in place. A special class of workmen do this class of work and seem to keep busy in filling orders. We expect to see the adoption of purely cement finished buildings increase very rapidly in the near future. One impediment at present which obstructs and hinders this class of construction is the labor unions who refuse to work on a structure, if cement is substituted for brick in the outside walls.

Several large Chicago buildings have brick walls with a 5 inch veneer block of cement on the outer face.

A CONFIDENCE GAME.

Mr. Lee K. Forsythe, the founder of the modern cement industry in Michigan, is no longer to be trusted. He is now working a confidence game through the country, pretending to represent capitalists who are seeking a location for a new cement plant. He obtains the confidence of his victims all for the purpose of having his worthless checks cashed and then he disappears. A woman bedecked with diamonds attends him in his travels. With this show of wealth he inspires confidence. Assuming that Mr. Forsythe was an honest man we gave him a letter of introduction to a friend, asking him to further Mr. Forsythe's efforts, all of which we now regret, and are therefore compelled to counteract this letter by denouncing Mr. Forsythe as a man to be avoided in his present avocation. We know of several parties who would like to interview Mr. Forsythe at present, while a late photograph of Mr. F. is very much wanted to assist in checking his operations.

The city of Neenah, Winnebago County, Wisconsin, is asking for bids, for the year's supply of Cement.—Address City Clerk for particulars.

City Engineer Harper of Kansas City, Mo., is advocating the establishment of a public warehouse for the reception of all cement to be used on city work in connection with a complete cement testing lab-

oratory, so that all cement used on city work can be tested and thus see that it conforms to city specifications.

The Wisconsin Portland Cement Company's plans for its plant at Lake Ennis are under way. The works are to cost \$400,000.

NEW USE FOR CONCRETE.

(Iron Age.)

Repairing breaks in the hull of a sunken steamer with concrete is a new departure, but one likely to prove frequently useful. The scheme was successfully tried upon the steamer George W. Elder, which was sunk in the Columbia river over two years ago, and remained under water many months. The boat struck on a jagged rock, which stove several holes in her iron hull; the principal one, about 80 feet from the bow, measured about 35 feet in each direction. Through this enormous gap the rock projected into the hold for nearly 11 feet. A bulkhead was built by divers forward of the break and another aft, and two more after of the engine-room. Heavy canvas was then placed over the rock, which projected up into the ship, and concrete was placed over the canvas until a heavy covering had been obtained. This was supported against the outside water pressure by a concrete beam athwart the hold, measuring 18x48 inches and 38 feet long. The concrete was mixed and placed under water by divers, the cement being sent down a chute in sacks and the stone in a box.

Other smaller breaks having been similarly treated, the water was pumped out of the hold and the vessel floated and towed 40 miles to a drydock. One of the problems connected with concluding the operations involved the relation between the capacity of the pumps, which were discharging the water from the hold, and the flow through leaks developing around the huge cement cone, and at other points in the hull which had been severely strained by the action of the current during the 16 months of submersion. By the terms of the contract under which the salvage operations were undertaken the successful wreckers received \$30,000, as against nothing in case of failure. The original owners had sold the wreck for \$10,400, and as the cost of repairs was about \$20,000, the outlay of the buyer amounted to about \$60,000. After the ship was ready again for service an offer of \$160,000 was made for her.

HOW TO PREVENT FAILURE IN CONCRETE CONSTRUCTION.

Dr. W. Michaelis, Jr., M. W. S. E.

(Read March 6, 1907, before the Western Society of Engineers.)

In the following I wish to present my views on the merits and limitations of cement and concrete and on the causes of failure in concrete construction, and will suggest means for the prevention of such failures. In doing so I will take my stand between the manufacturer and the user of cement, that is to say, I will discuss this subject as consulting engineer who is familiar with both the details of the manufacture of cement and its chemical and physical properties and with the use of cement as building material. This means I will not side with either the manufacturer or the consumer, but will be impartial and point out what can be expected of cement and what not. The manufacturer frequently greatly exaggerates the advantages of cement. According to him there is hardly anything in the building line that cannot be made of concrete. On the other hand, the engineer and architect, who are seldom acquainted with the intrinsic value of cement, with its physical and chemical properties, frequently make unreasonable demands and misinterpret the failures in concrete construction that unfortunately so often occur. In my mind, the best and surest way to advertise cement, to recommend concrete construction, and to make the engineer and architect gain confidence in this modern building material, would be to minimize the danger of failure as far as possible by proper building ordinances, which compel the contractor to handle the material in a certain prescribed way and to make proper tests which will make failures of buildings well-nigh impossible.

Concrete is a wonderful material in the hands of a skillful contractor and has many advantages over other building materials; but it is the unsafest of all materials, if it is handled by an unexperienced, careless and dishonest builder.

I shall dwell only in a general way on the wide possibilities of concrete construction and point out a few cases where concrete cannot be used:

Concrete construction is the art of casting or moulding in forms from a semi-wet mixture of cement, sand and crushed stone all those parts of a building which are otherwise erected out of brick, wood and steel, namely, foundations, walls, piers, girders, beams and floors. The result is a monolithic structure of

great rigidity if properly designed and erected. Concrete offers great resistance to compression, but only comparatively slight resistance to tension. Therefore we can make use of concrete proper in all such cases where it is chiefly subjected to compressive strength; for instance, for foundation work, walls, piers and columns. In all other cases, where it has to resist tensile stresses, as in girders, beams and floors, we have to reinforce it with steel of high tensile strength. The union of concrete and steel thus obtained can be made to answer any requirements as to compressive and tensile strength, according to the greater or lesser amount of concrete or steel used in each special case. Only in some cases the compressive strength of the steel is made use of at the same time as its tensile strength, namely, when the dimensions of the concrete work have to be reduced to a minimum, as often in columns and piers.

The type of the reinforcement depends upon the use to which the reinforced member is to be put.

Piers and columns are often reinforced by plain round rods placed near the circumference and connected by wire or ties. This kind of reinforcement is liable to be the cause of disaster, if an insufficient percentage of reinforcement is used, either in the designing or by negligence of the contractor, who may omit some of the bars. Columns insufficiently reinforced by bars, fail suddenly by pushing the steel rods apart. A safer way of reinforcing columns is to make use of spiral reinforcement. Such columns fail by bending and give ample warning before failure. You can hear a creaking noise of the compressed concrete and observe scaling off of the concrete on the surface of the columns; then the column is slowly bent out of shape before it collapses. This kind of reinforcement therefore should be used exclusively for columns which have to sustain heavy loads.

Girders and beams are reinforced by tension rods which are imbedded in those parts of the concrete which are subjected to tensile stresses. The reinforcement consists either of several single bars, horizontal and partly turned up, which are held in place by stirrups or U-shaped iron, or by bars like the Kahn-bar which represents a rigid combination of bar and stirrups. This latter method is much safer, because it makes it impossible for the contractor to omit some of the stirrups; more-

over, all parts must necessarily maintain their relative positions with respect to each other and chances of defective work from faulty placing of steel are largely avoided.

Floors and ceilings are likewise reinforced by steel rods imbedded in the lower part of the layer of concrete to take up the tensile stresses.

In all cases the mechanical laws that govern this type of construction are the same as in steel construction. Therefore the methods of calculation are the same. The only difference is that in steel construction we have to deal with only one kind of material, while in reinforced concrete construction we have to figure with two kinds of materials of entirely different physical properties. Of these we let as a rule the concrete take care of itself, whenever compressive strength is required, and call upon the steel reinforcement only where tensile stresses come in.

Our modern method of reinforced concrete construction frequently makes building possible on grounds on which other material can not be used. On wet ground, for instance where wooden piles would rot, reinforced concrete piles are driven, and on sites where the soil cannot be depended upon, as on river banks and sea shores, a solid foundation is obtained by a reinforced concrete raft, which transmits the load over the whole available area and which, owing to its rigidity does not give way, even if there should be a settlement of the ground at any particular point.

The monolithic connection of foundations, columns, girders, beams and floors, on account of its unequaled rigidity is a decided advantage of reinforced concrete construction over the freely supported girders and beams of wood and steel construction. This superiority of concrete structures becomes one of the strongest points, in places where earthquakes have to be considered.

However, concrete cannot be used everywhere, as there are some limitations to its use. In some parts of the country cement is too expensive or good sand or crushed stone cannot be obtained. In others the high cost of lumber for forms excludes concrete construction. This latter point becomes more and more serious from year to year with the growing advance of the price of lumber. The cost of the wooden false work and the labor cost of installing and removing it amounts sometimes to 50 per cent of the cost of the structure. In such cases another method has been adopted,

which does away with a large percentage of the lumber, namely, the casting on the ground of columns, beams, girders and floor slabs, which are afterwards hoisted and erected as with structural steel work. This saves the centres and supports and reduces the cost of erection but at the same time, it sacrifices the main advantage of concrete structures, namely, their monolithic nature; this impairs their superiority over steel structures formerly referred to.

The erection of a concrete building, as a rule, takes considerably more time than that of a steel structure, at least if it is done with care and if all parts are given plenty of time to set before removing the forms. This is a big item in the cost of the building, in case of a large office building or hotel, because every month which it takes longer to erect the structure means a considerable rent loss of the building. Some cases, however, have been pointed out where the erection of a concrete office building has not required more time than that of a steel skeleton building. But such practice is extremely dangerous and should not be approved of, unless the contractor can demonstrate by continuous tests that the concrete work is strong enough to sustain the superimposed load and that he is justified in removing the forms.

The principles governing modern reinforced concrete construction are thoroughly understood only by comparatively few. This explains why engineers and architects are slow in adopting this type of construction and, furthermore, accounts for the divergence of opinion in many points pertaining to the science of this branch of the building industry.

While some engineers are careful in specifying concrete of ample strength, others blame such "over-cautious" builders for making use of an excessive factor of safety. The aim is, of course, to reduce the cost of concrete as far as possible in order to give it the widest application possible. But if engineers fail in their efforts to prove that for a given case, concrete work would be less expensive than steel construction, they frequently blame the cement for it, and we hear all kinds of theories advanced. They will say, for instance, that cement is not sufficiently uniform at present, and they claim that if cement could be so manufactured as to give as uniform tests as does steel, it would be possible for the engineer to reduce the larger factor of safety now demanded for concrete over that re-

quired for steel. Such a statement is entirely without foundation. Cement is manufactured sufficiently uniform nowadays, at least by those plants that can depend upon uniform raw materials. Cement can be manufactured as uniform as steel. But in comparing the cost of steel and concrete construction and their respective safety factors we are not allowed to compare steel with cement, but steel with concrete. Steel is a well-defined chemical compound rolled into the desired shape. Concrete, on the other hand, is the sum of a number of factors, namely, of cement (a chemical compound equally well-defined as steel and ground to the desired fineness), of crushed stone, of sand, of water, of honest workmanship, and of a great deal of care, a combination of which cement is a comparatively small part. This reflection teaches us that the calculation of a steel girder and that of a reinforced concrete girder or beam can never be based on equal safety factors, no matter how much the properties of cement might be improved in the future.

Moreover, cement will not be improved in the future; we have arrived at the limit of its good qualities. In making this statement, I refer to Portland cement, of which every builder in this country thinks whenever the general term "cement" is used. Why can Portland cement not be improved? In order to be able to answer this question, I must remind you that Portland cement is a product obtained by calcination of an intimate mixture of finely pulverized limestone and clay or shale, and that it consists of calcium silicates and calcium aluminates. Clay and limestone may be mixed in all possible proportions, the result from a chemical standpoint will never be anything better than our present commercial Portland cement. Then, if the chemical composition of Portland cement cannot be improved, cannot its physical properties be altered, can it not be ground more finely? Yes, this latter can be done, indeed, but it would not be of any practical value.

Recent investigations have proven that of our commercial Portland cement only from 30 to 40 per cent possess cementing properties at all; the remaining 60 to 70 per cent represent inert material. Until a short time ago, you could read in the cement literature that the cement remaining on a 200-mesh sieve is too coarse, that is to say, has no hydraulic properties, and that everything that passes the 200-mesh

sieve represents the active part of the commercial cement. Today the 200 mesh-sieve exists only for the manufacturer in order to enable him to grind his clinker always to a certain fineness required by the specifications. The experimenter, however, can no longer make use of so coarse a screen as a 200-mesh sieve. He divides cement into that part which remains on an 800-mesh sieve, which is inert (about 60—70 per cent), and that which passes the 800-mesh sieve (30—40 per cent), which is cement proper. Of course, an 800-mesh sieve does not exist. It would have meshes 1.1600 (one sixteen hundredth) of an inch wide and would consist of wire gauze of the same thickness. In order to obtain this fineness, the imaginary sieve is replaced by a process of decantation or elutriation in a current of alcohol of a certain velocity which separates the fine from the coarse and leaves the grains that measure more than 1.1600 (one sixteen hundredth) of an inch under the microscope.

If the manufacturer would grind his Portland cement to this extreme fineness or even only to a fineness between the 800-mesh sieve and that of the commercial cement of to-day, say to 70 per cent passing an 800-mesh sieve, the result would be so quick-setting a cement that nobody would be able to use it in practice. A person can make a neat or a sand mortar briquette of it possessing a strength in a day or in a week several times higher than the strength obtained from Portland cement of the present fineness, but this is only under the assumption that the mortar be gauged with the water less than a minute. If the gauging would continue for several minutes, no higher strength than for ordinary cement can be obtained. This is due to the quick-setting qualities of the calcium aluminates in the Portland cement. No addition, however high, of any retarding element, can prevent this. So finely ground a Portland cement, therefore could not be used in actual practice, where under the best conditions a quarter of an hour is required from making the concrete until it is tamped into the forms or moulds. I have frequently made such experiments with cement of extreme fineness separated from the coarser particles by an air-current, for instance, with cement that had been collected on the top of a 30-foot ventilating tube over grinding machinery, and from these experiments I know that such Portland cement will never fulfill the

demands of engineers and architects who are eagerly looking for a cement of higher crushing strength than our present Portland cement. Architects rightly wish, both for economic and mechanical reasons, to disuse reinforcement in concrete columns. As long as they make use of Portland cement for their concrete, they will have to design columns of enormous proportions, if they want to omit reinforcing bars or spiral reinforcement. Therefore the desire for a much better grade of cement, which according to a recent utterance of a well known-engineer, "would receive an enthusiastic reception by all engineers." Fortunately such a cement exists.

The cement to which I refer is "Iron-ore Cement" which has been manufactured for several years by the Hemmoor Portland Cement Company of Hamburg, Germany, and which I hope will soon be manufactured in the United States also. This cement is made of limestone and iron-ore instead of using limestone and clay as in the manufacture of Portland cement. It was originally manufactured with the sole intention to replace Portland cement for sea-water construction, because Portland cement goes rapidly to destruction under the influence of the magnesia sulphate contained in the sea-water, while iron-ore cement is not acted upon even by the most concentrated solution of sulphates. This iron-ore cement, if ground to the fineness of commercial Portland cement, is very slow setting, because of its chemical composition which differs from that of Portland cement in as much as the aluminates of the Portland cement are replaced by iron compounds, by calcium ferrites. The aluminates of the Portland cement, as mentioned above, are the cause of the quicksetting properties of Portland cement. The calcium ferrites of the iron-ore cement, however, hydrate only slowly, so that this cement has only a comparatively low strength after a day or a week. But its strength steadily increases from month to month and year to year, reaches soon that of Portland cement and in time far exceeds its maximum strength, so that a barrel of iron-ore cement goes much farther than a barrel of Portland cement even under ordinary conditions, that is to say, if both are ground to the same present day's fineness. Now let us grind iron-ore cement to extreme fineness, which can easily be done by air-separation; then it will

finally become as quicksetting as commercial Portland cement is now, it will contain perhaps 70-80 per cent of active material in opposition to the 30-40 per cent of Portland cement of the same setting properties and a barrel of such finely pulverized iron-ore cement will replace three barrels of Portland cement and will enable the architect either to use leaner mortars or to considerably reduce the dimensions of columns and beams, while, as mentioned before, the same cannot be done with Portland cement. Moreover, a better grade of cement could be shipped farther, as the consumer would obtain in the contents of one barrel of cement the same amount of cementing material that he gets out of three barrels now.

In the foregoing I have pointed out the advantages and disadvantages of concrete work and of various kinds of reinforcing systems and have discussed what can reasonably be expected of Portland cement, and furthermore have mentioned the demands of engineers and architects for a higher grade cement which the future will fulfill. Now let me proceed to the next chapter in which I will discuss how, with our present knowledge of concrete construction in mind, the deplorable accidents can be prevented of which we hear so often.

As said before, cement is nowadays manufactured so uniformly and is generally tested so thoroughly at the plants before being shipped, that only comparatively few cases are possible in which the cement is to blame for the failure of concrete work. In most cases the builder has to blame himself for the collapse of a structure. In work of minor importance, for instance in sidewalk work or in the

manufacture of concrete blocks, failures can be noticed every day. Where cement is used on a comparatively small scale as in these branches of the industry cases happen, where failure is due to poor cement, as only the consumer of large quantities of cement makes tests of his own and can find out in advance, whether or not he has received a reliable product from the manufacturer. Thus it sometimes really happens that a small consumer receives a carload of cement, which has not the proper setting time, and which he kills in working with it. Cement companies who have not uniform raw materials or whose materials are too high in alumina often have trouble in regulating the setting time and they supply the consumer now and then with a cement with which he is unable to work. To this group of manufacturers likewise belong those companies who do not pay enough attention to thorough vitrification of the clinker. If the clinker is merely burnt to a point of beginning vitrification, if a friable clinker is obtained which just passes the specifications after a little curing and doctoring, it happens that this cement disintegrates after having been shipped, changes its setting properties and becomes a quick setting cement, while it may have had a medium setting time when it had been tested at the works. In using the term "disintegrate" in this case I do not want to refer to the dusting on cooling of overburnt clinker or clinker too high in silica, but speak of the breaking up into smaller fragments which every clinker shows on aerating, unless it is burnt to a dense, vitrified piece of rock. Such a cement is ground at the factory like all others to the fineness of a commercial cement.—About 30 or 40 per cent of it would pass the 800-

IMPORTS OF CEMENT INTO THE UNITED STATES.

WHERE FROM	JANUARY				SEVEN MONTHS ENDING			
	1906		1907		1906		1907	
	Quantity in lbs.	Value in Dollars.	Quantity in lbs.	Value in Dollars.	Quantity in lbs.	Value in Dollars.	Quantity in lbs.	Value in Dollars.
United Kingdom . .	67,200	\$ 231	2,800,000	\$ 9,983	6,830,780	\$ 21,336	168,648,264	542,009
Belgium	1,786,041	4,096	35,268,829	95,421	71,467,468	221,084	207,541,305	661,363
France	1,787,800	6,124	1,698,500	7,286	5,307,160	19,570	21,896,684	71,011
Germany	18,941,739	65,914	21,178,654	61,620	131,773,306	442,683	268,868,698	845,496
All Other Europe . .	—	—	729,349	1,551	—	—	20,629,070	61,741
British North Am. . .	—	—	76,000	531	39,650	247	2,572,283	18,746
Other Countries . .	6,000	60	227,200	1,327	53,855	498	54,026,807	254,975
TOTAL	22,588,780	76,425	61,978,532	177,719	215,472,219	706,018	744,183,111	2,455,341
Domestic Exports of Cement, bbls. . . .	43,782	72,665	59,573	105,345	582,167	813,424	371,679	625,829

There were 7,625,551 lbs. of imported Roman and Portland Cement, etc., in the United States bonded warehouses in January, 1906, valued at \$21,504, against 11,112,644 lbs. in January, 1907, valued at \$32,670.

For seven months ending in January, 1906, there were 40,059 tons of asphalten imported in the United States, valued at \$174,401, against 62,245 tons imported in seven months ending January, 1907, valued at \$247,884.

mesh sieve, when it is tested before leaving the plant. But it continues to disintegrate after being packed in sacks or paper bags; the moisture of the atmosphere breaks up every little particle into smaller fragments and in time the percentage of the extremely fine powder is found much higher than when shipped and the result of it is, that the cement which may have set in two or three hours when tested at the plant, now begins to set instantaneously. There are only very few consumers of cement or even chemists and superintendents of cement plants who are able to detect this. If you give them a cement which begins to set in 5 or 10 minutes, they will find it out, but if they get hold of a cement which sets immediately, they frequently do not discover the fact, and afterwards wonder at the poor results obtained with it. Some six years ago commercial cements of even the largest plants of the Lehigh Valley could frequently be found to set instantaneously, although the men at the works were not conscious of the fact. But nowadays such cases become more and more rare, and we may safely say, that in nine out of ten cases the consumer of cement is to blame, if we consider only sidewalk work or the manufacture of concrete blocks. In these branches of the business we see any number of incompetent people engaged, who handle a few dozen barrels of cement a day, who cannot be expected to make elaborate tests of cement and who would not be able to make them correctly, even if they wanted to. In all other cases, where work of larger proportions is involved, namely in the construction of residences, factories, office buildings and hotels, the manufacturer of cement can never be blamed for failure during the course of construction, because it is the business of the builder to test his cement thoroughly before using it. The building ordinances of all states should compel builders to submit the cement to thorough tests before using it, no matter how well-known a brand of cement they may have bought, and the license should be withdrawn from them, if they do not comply with the demand. Such a law would obviate the few possible cases, where cement might otherwise be blamed for destructive failures. After this has been settled we would have to consider how the many failures can be prevented, where the builder himself is at fault.

In order to understand the situation we have to ask at first: In what differ masonry and steel construction and concrete construction? The old-fashioned way is to erect structures out of material of known strength by piling brick of a certain compressive stress, one on the top of another, to construct walls and piers and then to connect the piers by means of wooden or steel girders and beams of known strength. In steel structures the masonry piers are replaced by steel columns to which are securely riveted steel girders and beams which carry the floors. In this class of construction comparatively few failures can occur, if the designs have passed through the hands of a careful board of building examiners and if the material, brick, steel and wood, conform to the specifications. The members may be jointed and riveted together in a negligent way; but this can easily be detected by building inspectors and careless work can be ordered to be replaced. In concrete construction, on the other hand, the strength of none of the members of which the structure is composed is known in advance, neither that of a pier, wall, girder nor beam of any description. The designs may have passed through the hands of competent and careful examiners, who may have scrutinized every detail of the construction and found it to conform to other previous designs which have proved a success, and yet the erection of the building may result in complete failure and great loss of life. No other building material is apt to result in destruction of equal magnitude, if handled carelessly. All that the builder of concrete work knows, when starting to carry out the design before him, is the strength of the cement and that of the reinforcing bars, if he has gone at all to the trouble of having both examined, one for crushing stress and the other for tensile strength. Then he proceeds to erect the forms and supports, mixes crushed stone, sand and cement in certain proportions and tamps the concrete into the moulds. After a certain time he comes to the conclusion that the concrete has had time enough to set, that he needs the centering at some other part of the building, and orders his men to remove the forms; and in many cases it is more or less of a pleasant surprise to him, if the building does not collapse on striking the forms. Experienced contractors who can depend upon a well trained gang of workmen and have reliable men under them to

superintend the work, will be able to tell quite well how much of a load a column or beam will stand after a certain time, but with most contractors it is only guesswork, and such a state of affairs should not be tolerated.

Before a railway company is allowed to entrust the life of passengers to railroad cars, have they not to test every part of the structural material that goes into the design of a car and do they not break one wheel arbitrarily selected out of a certain number before they draw definite conclusions as to the safety of the materials? And in masonry and steel construction are the crushing strength of brick and the tensile strength of steel not carefully determined before they are used for construction work? But have you ever heard that builders of concrete work have carefully ascertained the actual strength of a beam or girder before removing the centers? I have not. They may occasionally make a few tests on the tensile strength of the cement, which they have bought, but hardly ever on its compressive strength, or they may even go as far as making a few concrete cubes from the materials which they use later on during the construction; but all of these tests do not permit them to draw any definite conclusions as to the actual strength of the concrete which goes or has gone into foundation work, walls, columns, girders, beams and floor slabs. I do not wish to be misunderstood and therefore will immediately mention the numerous tests of girders, beams and floors which have often been made in order to demonstrate the merits of thorough reinforced concrete work and which have proven what excellent work can be done by experienced contractors. But in opposition to such work we have to contend with work which results in failures like the collapse of the Bixby Hotel at Long Beach, California, and that of the factory building of the Eastman Kodak Co., at Rochester, N. Y. These failures have proved that the concrete, which can be made of the materials on the premises and which probably has been made in the form of a few concrete cubes before starting operations, and the concrete that is actually made during the course of construction are in many cases two entirely different things. Therefore by insisting upon continuous tests of the concrete which goes into girders, beams and so forth. I described to you before, that cement is only a comparatively small fac-

tor in the manufacture of concrete and that in addition to sand, gravel, crushed stone and water a number of other factors have to be taken into consideration, namely great care and honest workmanship. How true this statement is, you may see from the causes of the collapse of the two structures just referred to.

From the information received on the subject it is evident, that in the first place both structures were designed too weak. The architects in both cases should not have been allowed to erect the structures, and it may be that they would not have received a building permit, if the buildings would have been erected in one of our large cities. But I am not sure as to this, as the building inspectors even of our largest cities have no reliable standards and data to work from. In fact the buildings have been erected in small towns or suburbs, and the drawings have not been submitted to competent public officials. In both of these structures the columns seem to have been the weakest part of the construction. In one case, at the Bixby Hotel, the columns have been of apparently ample proportions, namely 21, 20, 16, 12, 12, and 10 in. sq. from basement to fifth story. But the reinforcement in these columns consisted only of four $\frac{1}{2}$ in. rods, which were tied together by wire at intervals of about 16 in. In the case of the Eastman Kodak Company's building the drawings called for columns 18 in. sq. up to the main floor and 12 in. sq. above it, and the reinforcement was supposed to consist of four $\frac{3}{4}$ -in. rods and four Kahn-bars in the lower part of the columns and of four Kahn-bars in the upper stories. If the columns had been built according to these specifications, they would have been too weak anyway for the heavy load which they were expected to sustain, or at least the design would be called defective, because it did not make use of a proper factor of safety. But the contractor did not even make the lower part of the columns 18 in. wide, he made the columns 12 in. wide throughout and, moreover, omitted in some of the columns the reinforcing rods and reinforced them only by four Kahn-bars all the way through.

The four $\frac{1}{2}$ -in. rods at the corners of the columns of the Bixby Hotel which had a sectional area of 400 and 250 sq. in. in the lower part of the building you can imagine cannot have been of much consequence. The Kahn-bars in the columns of the other structure have not been of

much more use. They represent plain bars with stirrups fastened to them and are, from a theoretical standpoint, better than rods of course, but have this disadvantage that their prongs or stirrups, which point up and down in the columns, and are bent at an angle of 45 deg. to the bar proper, are in the way in tamping the concrete into the forms. For the columns in question which had to carry a very heavy load spiral reinforcement would have been the proper thing, and I hope the time will not be far, when reinforced concrete construction will be standardized to some degree and the building ordinances will only admit such kinds of reinforcement which offer plenty of security, for instance exclusively spiral reinforcement for all columns in the basement and lower stories of high structures, and Kahn-bars or similar reinforcement for girders and beams, where they are in their proper place.

But faulty design has not been the sole cause of the terrible accidents which accompanied the collapse of the two buildings. Only parts of the buildings came down; most of the columns were just strong enough to carry the superimposed load. To defective design was added careless or even dishonest workmanship.

The concrete work in many parts of the building of the Eastman Kodak Co. had been done with so little care that at a number of columns and girders the reinforcing bars showed at the surface and that the bars of the girders were frequently not surrounded by concrete, showing that no care had been taken in tamping the concrete under the bars. Some girders were deformed by carelessness in bracing the forms; and porous concrete and long internal cavities, several inches deep, could be detected everywhere in columns and girders. Moreover, at many places the concrete plainly showed that it had been made with dirty sand, and leaves, saw-dust, shavings and even blocks of wood could be discovered in the concrete. Although the same gross negligence in making the concrete could not be stated after the Bixby Hotel failure, it is apparent that weak concrete work in some of the columns must have been the cause of the failure, thus giving a start to the collapse of the entire middle section of the building. Hence the columns of the Kodak building were slightly better in design and the collapse was mainly due to careless workmanship, and to the too

early removal of the forms, while in the case of the Bixby Hotel, faulty design was the primary cause and weak concrete at a number of places and the too early removal of the wooden supports was the ultimate cause of the disaster.

Those of you who know how little attention is frequently paid to thorough mixing of concrete and with what haste the work is done, will understand that poor concrete is a very common cause of failure. The work is often done automatically; crushed stone, gravel, sand and cement are fed into the mixer in the desired proportions from individual hoppers. Unless the supervision is very severe in such a case, it may happen that one of the hoppers chokes and the material flows less freely, thus entirely changing the proportions of the concrete. Such unintentional mistakes amply suffice to bring about disaster; but if to these intentional carelessness is added and the concrete is weakened wilfully hardly anything but failure can be the result.

One or the other of the above mentioned weaknesses in the design or in the concrete work may be present in any concrete construction, and the contractor can never be absolutely sure that his building will not collapse on removing the woodwork from under the floors and girders, as long as he proceeds the way he has done so far. The removal of the centering is the critical point and the time when the accidents are liable to happen. In many cases the forms are removed when the concrete is still quite soft; it may not have had time enough to harden or the concrete may have been spoiled while being mixed, or concrete partly hardened may have been stirred up again and mixed with additional concrete. The reasoning of the contractor will mostly be, that it has had time enough to harden and that the forms and supports have to come down, because they are needed at some other part of the building. Moreover, a floor that may have set for a sufficiently long time to carry its own dead load, has frequently to carry the supports and floors of one, two or even three stories above it, which are in the course of construction. The floor may not have been designed for such a load at all or at least it cannot be expected to carry several times its own dead load after so short a time, but nevertheless the contractor will strike the centering, when he should know that the collapse of the floor panel is almost inevitable.

What can be done to prevent such reckless building? Shall the careful contractor suffer for the negligence of the incompetent builder, as is now the case, because every additional report of the failure of a concrete structure tends to decrease the confidence of the public in this modern construction, or can something be done to make it impossible for the contractor to erect buildings of improper design or to remove the wooden supports before he has convinced himself and the building inspectors or the agents of the owner of the structure, that every part of the building is amply strong enough to carry the load for which it has been designed?

In my opinion failures can materially be lessened, if not entirely be prevented, by proper building ordinances which make it compulsory to use concrete of specified proportions of crushed stone, sand and cement, to use the proper kind of reinforcement in each case and the necessary amount of it. Certain standard rules should be laid down by a board of building examiners and certain types of reinforcing material should be excluded where they are not in their proper place. In addition to these points which refer to the designing of the structure, the erection of the building should be accompanied by continuous tests of the concrete that goes into the construction and the builder should be compelled to inform himself of the strength of each column, girder, beam and floor slab before striking the forms and placing the load upon them. In the following let me explain to you what I mean by this and let me illustrate how I should like to see such building laws drawn up. In order to facilitate this I will make use of the data relating to the columns of the two collapsed structures, which I have formerly described and with which you are familiar and will show how proper ordinances can prevent similar faulty construction.

Some building ordinances speak of concrete only in a very general way; they specify a certain load "per square foot of concrete," which shall not be exceeded in the design, but make no mention of the proportions of the various substances that make up the aggregate and thus make it possible for the architect to specify 1:4:10 concrete in places where 1:2:4 or 1:3:5 would be the proper ratio to use. I have more than once heard contractors argue that, in certain walls and piers a mixture of 1:4:10 would do, when

I had specified the work to be made of 1:3:5 concrete.

Moreover, the nature of the crushed stone and sand should be taken into consideration. The stone should be submitted to tests for compressive strength, so that the contractor may be sure that it does not weaken but strengthens the concrete. The best of all would be to have the contractor determine the voids in the crushed stone and in the mixture of crushed stone and sand, and thus to find the most favorable ratio of cement to stone and sand, as this varies with the nature of the aggregate. By these means the contractor may not only obtain a harder concrete, but in many cases considerably reduce the cost of it.

The percentage of reinforcement should be specified for the various mixtures of concrete and for varying loads, so that it may not happen again that an architect tries to reinforce a 20-in. column in the basement of a five-story building by four $\frac{1}{2}$ in. rods, that is to say, by less than $\frac{1}{4}$ per cent of reinforcement. If he had taken sixteen 1-in. rods for the same columns, the structure would not have collapsed. The columns are naturally the points from where the greatest disaster is to be expected, as their failure causes an entire portion of the structure to come down, while a weak girder or beam can only be the cause of the collapse of a floor panel. Therefore columns should be heavily reinforced and preferably only by reinforcement which gives ample warning of a coming disaster, as, by crumbling and scaling off of the concrete on the outside of the column. Such reinforcement is spiral reinforcement of the Considere type or expanded metal cylinders. These should be used exclusively for columns, which have to sustain heavy loads, and bars of any description should be prohibited.

For girders and beams, trussed bars like the Kahn-bar should be preferred to single bars, which are simply connected by stirrups, as the former represent units which cannot be as easily moved out of place in tamping the mortar into the forms.

The thickness of the wooden planks and wooden supports of the form should be specified for each load, so that girders and beams are not deformed during the tamping of the concrete.

In the construction of floors it should not be allowed to erect the woodwork for the next floor above

it on the green floor. This method of building the floors imposes too much of a load on the fresh concrete. The forms of the floors should be supported independent from the floor underneath by inclined posts, so that the weight of the forms and floor shall rest upon the columns and girders and not upon the floor underneath. Or in case the former method of construction has been adopted, the centering should be removed only when the top floor or roof has set hard, and then the removal of the planks and supports should begin at the top and not at the bottom, so that a comparatively fresh third floor has not to sustain the load of three or four floors above it with all the woodwork between them.

The requirements of which I have spoken so far, dealt with the design of the structure or the method of erecting it. We now have to discuss such methods for testing concrete as might reasonably be forced upon the contractor in order to assure success.

From my previous description of negligent concrete work you will have seen, that it is not at all sufficient to test the cement, crushed stone and sand. The contractor may have the best materials on the grounds, that can be imagined for the purpose, and yet he may make them into a weak concrete and his work may result in failure notwithstanding skillful design and proper and sufficient reinforcement. Therefore I regard it as the most important point in concrete construction; that every contractor, who undertakes to erect buildings, more than one story high, should have a small shed on the grounds which is more or less equipped as a testing station according to the amount of work he undertakes.

The main equipment of such an experimental station should be a powerful hydraulic press which enables him to crush 6-inch concrete cubes. During the course of construction he should take a sample of the well-mixed concrete that goes into the construction work and should fill a mould with it at the time the concrete is being tamped into the forms. This should be done for every cubic yard of concrete that goes into columns, girders, beams and floor slabs; it might be done less frequently with foundation work, where larger amounts of concrete are involved. The moulds should be set aside and should be numbered, so that for each test piece it is known with which part of a column or with which

girder or beam it corresponds. Then before striking the forms the contractor should crush his test cubes and determine their resistance to compressive stress. This alone will tell him whether or not he can safely remove the woodwork. There should be several test cubes for every 5 or 10 feet of a column or girder, so that an average from 2 or 3 tests is obtained and that still some test pieces remain for future dates, if the strength is not found to be satisfactory, when being tested the first time, and if consequently the concrete work has to be allowed to harden for an additional week or two. Such tests would show the contractor at which part of his construction weak concrete has been used. He would have to give that special part of the building more time to harden or can remove it in time and replace it by better concrete, if he notices that the test cubes which he keeps do not increase in strength from week to week.

The figures which the contractor obtains from his test cubes submitted to compressive strength will enable him to calculate the load that a column is able to sustain. He knows by experience or from observations of competent experimenters how much he is allowed to add to the strength obtained by his tests for every per cent of reinforcement of a certain type which he has imbedded in the concrete.

As ideal of a test would suggest itself to make it compulsory for the contractor to build at his testing station an additional part of a column or an additional girder or beam with the necessary reinforcements for, say, every ten columns or girders that he makes, and to break these test pieces by powerful machinery or by loading with pig iron before removing the centers of the corresponding parts of the building. But this would be very expensive; most contractors will object to my very modest demands anyway, as they naturally increase the cost of erection. My standpoint, however, is that concrete is not worth using, when misused, as frequently nowadays. Unless the contractor can afford to make tests, which alone assure safety, let us use other building material, which is more reliable, until the time when concrete construction will be sufficiently protected by proper building laws. However, tests of whole girders and beams, one for every ten of the construction work, would hardly be as reliable as might be expected at the first glance. Every

contractor who would have to make such a test piece, would naturally take more pains in making it and in mixing the concrete for it than in making the original ten columns, girders and beams. Therefore the best method of controlling his work appears to be the continuous testing of the concrete as previously stated.

Much excellent work has been done these last years in the way of testing concrete work at well equipped experimental stations, for instance by Professor Talbot of the University of Illinois, by Mr. Harding of the C., M. & St. Paul Railway and by Mr. Van Ornum and others. Through their work we have received insight into the various phases of failure of beams and columns and have been taught the advantages and disadvantages of different methods of reinforcing; briefly we have been familiarized with a subject about which very little was known up to a short time ago. To these same experimenters I wish to appeal in this paper and should like to request them to bring their highly scientific methods of testing down to the plane of actual practice. They have laboratories which are thoroughly equipped for this purpose and will be able to contribute a great deal to leading concrete construction the right way, if they only realize our wants. What we need is short and inexpensive tests of concrete and formulas which permit us to draw reliable conclusions from tests of concrete. If mathematical laws could be established which would allow us to compare figures obtained from concrete without reinforcement with those obtained from reinforced concrete, we could omit elaborate tests of complete beams and girders. For instance, it would be of great practical value to know the loads which can safely be sustained by a 10-ft. beam reinforced with Kahn-bars, by a beam of the same dimensions without reinforcement and by a beam of half or one-third this length. If a certain ratio could be established between these three, the contractor could make test pieces of small beams without reinforcement, as he goes on with his construction, load them until they break, and thereby draw conclusions as to the load that the 10-ft. reinforced beam of the structure can safely carry at the time of the test.

The experiments of the above mentioned investigators enable us to properly design any part of the structure, since we know the behavior of concrete and steel under

different conditions and the effect of repetition of load and retention of load. The principles which they have established by their work are of great value to the designer. But the contractor would have to go the reverse way, if he would follow my suggestions. The only known data for him would be the figures obtained from his test pieces and from these he would have to draw his conclusions. Thereby he would check the calculations of the designer and give the only reliable proof of the safety of the construction. I realize that it will not be easy to establish rules, which will permit of drawing conclusions the reverse way; it would require a large number of comparative tests. But even approximate figures would be of great value for the guidance of the contractor until the day, when every phase of this science will be fully worked out.

If a few of our large cities would make a start and adopt such building ordinances as I have suggested, smaller towns will soon have to follow their example and it will be known among the building public, where ordinances exist which safeguard concrete construction and where not. Then every prospective owner of a building, no matter in which state or town or country place he may be, will be in a position to stipulate in his contract with the engineering firm or contractor who attends to the designing and erecting of the building, that in every detail the design and erection of the structure shall conform to the building ordinances of the City of Chicago or whatever the name of such a town may be.

In order to attain the desired results the co-operation of everybody interested in concrete construction is earnestly requested. All experimental stations equipped with the proper testing apparatus should offer their services for the sake of public welfare and every builder and contractor should in his own interest see to it that such laws and ordinances are drawn up and enforced. Only this will make concrete construction a safe enterprise and prevent it from falling into discredit. The commissioners of buildings of our large cities would have to take the lead in this movement and to consult competent men on the subject, so that ultimately everything possible is done to prevent failure in concrete construction by enforcing upon the designer and contractor certain standard rules and methods of testing, and that yet no unreasonable demands are made.

If all this has been attained, reinforced concrete construction will become the most widely used method of building. But, so far, concrete is the building material of the widest possibilities and yet the unsafest to use.

In the course of the discussion of his paper Dr. Michaelis, Jr., reviewed the various building ordinances of the United States and compared them with those of European countries. He pointed out the peculiar condition which confronts us in the United States, namely that we are unable to exercise the same control as European countries do with their larger staffs of trained inspectors. Consequently we should strive to obtain not only building regulations as safe as those of European countries, but we should add to their building codes a number of ordinances which especially protect those features of the construction from which the greatest amount of disaster is apt to result.

We quote hereafter the full text of the information given by Dr. Michaelis, Jr., during the discussion, as this forms a valuable supplement to his paper:

Discussion.

Dr. W. Michaelis, Jr.: Since this paper has been written, about two months ago, some additional failures of concrete structures have occurred. I mention the collapse of a 176 ft. reinforced concrete chimney at Louisville, Ky. The disaster was due to the poorest kind of concrete and to the lack of a mechanical bond between horizontal and vertical reinforcement, or in other words, it was caused by defective workmanship and insufficient inspection.

After having listened to the numerous accidents of which I have spoken, nobody will be able to deny that there is something radically wrong with our building codes, and in fact this has been frankly admitted by a number of engineers since the appalling disasters of the last half a year have startled the engineering world. But so far nobody has proposed a satisfactory remedy.

Some associations have since come to the conclusion to educate people by proper literature. This is a very praiseworthy intention of course, but it will not be effective alone. Since a number of years the American literature is not at all deficient in good books and articles on the subject, and the men who designed and had charge of the work which resulted in failure were not necessarily ignorants in

in their profession. Keen competition forced them to underbid others and as a result of this, they rushed the work and became less watchful than before. Inefficient inspection, therefore, is at the root of all disaster. It is not at all sufficient to have good literature and building laws which teach how to do the work or how it might have been done. The main thing is proper supervision on the part of building inspectors who understand their business and who will compel the contractor to prove to them that the work has been done the right way. These tests should be made before removing the wooden supports.

If we review the various building regulations existing in the United States we find some, for instance the building codes of New York City and of Chicago, that contain some meager information upon which a sensible engineer can base a successful design, if he properly superintends the erection of the work, which is fortunately done in most cases. But building ordinances should be of such a nature, that the erection of concrete structures is accompanied by success not only in the majority of the cases, but in every single instance. Many building regulations contain arbitrary time limits, which offer no safety whatever. The minimum time is stated which the forms must be left in ordinary weather. In cold weather this time has to be lengthened "according to the judgment of the foreman." For instance some of the rules demand: "The forms may be removed in the case of heavy walls after one to three days or until the concrete will bear pressure of the thumb without indentation." You can imagine that a concrete which will merely bear pressure of the thumb cannot be very strong, but nevertheless such a test is found sufficient in the case of a heavy wall. All United States building ordinances relating to concrete construction are deficient in the point of inspection. They stipulate that the contractor must be prepared to make tests within a reasonable time after erection, as often as may be required by the superintendent of buildings. This means in many cases that the tests have to be made after a number of workmen have been killed during the removal of the forms. The tests should be made before the supports are removed. For this purpose it is sufficient to expose part of a column or wall or occasionally an entire beam.

If we consider the factors of safety which the various building ordinances of this country demand, we find safe figures in the case of our large cities:

For concrete in girders, beams and floors they make use of a factor of safety of 4, and for columns and piers of 6. For steel they use a factor of safety of 2, and in some cases of 3.

These figures are about the same as customary in other countries with the exception of Germany. The Prussian Government demands for beams and floors about the same factors of safety as our large cities of the United States, namely for concrete 5, for steel 2. But in direct compression, in columns and piers, they prescribe factors of safety of 10 for concrete and of 5 for steel. The latest edition of the excellent book on "Reinforced Concrete" of the English civil engineer, Mr. Charles F. Marsh, contains a translation of the Prussian Government regulations which are so far the most complete and most effective. In a foot note Mr. Marsh comments on the factor of safety of 10 demanded for concrete in direct compression and says: "This factor of safety is much too large; a factor of 5 is quite sufficient." In this remark he may be correct as far as Great Britain is concerned, but in the United States no factor of safety can be too large, since supervision is absolutely inadequate in this country as the many accidents prove. That the Prussian Government demands so high a factor of safety for the designing of columns and piers, certainly shows much forethought. They thus protect the most those parts of the construction from which the greatest amount of disaster is apt to result. Moreover, to severe demands in the design of a structure the Government of Prussia adds the most rigorous inspection. The building inspectors thoroughly examine every column, girder and floor slab before the woodwork is removed, and thus prevent all such failures which otherwise would be due to the too early removal of the forms, which is the most common cause of disaster in the United States. Furthermore, European builders are allowed to erect only one story at a time, and to start the next only after the building inspectors have made sure of it, that the first story is sufficiently strong to carry the load.

The governments of all countries belonging to the "International Society for Testing Materials" have tried to standardize building meth-

ods during the last twenty years. However, it will take a long time yet before some definite rules can be laid down for concrete construction, as this youngest branch of the building industry is still in its early development, and as the principles governing it are not yet fully established. In the meantime, until this type of construction will be thoroughly understood, other countries successfully prevent failure by proper building ordinances and a very rigorous inspection during the course of erection, but this country unfortunately does not possess similar building laws and an efficient inspection which would obviate disaster.

Building ordinances for concrete construction that are found to be effective in other countries can not simply be copied and be applied to this country. Even if this country would adopt building ordinances as severe as those of European countries, I am afraid concrete construction would not be much safer than it is now, unless such ordinances be accompanied by laws which compel the contractor to make continuous tests of the concrete in the way I have suggested in my paper. In the United States the weakest point of a law is, that it is not enforced. This is a well-known fact that can daily be proven in a thousand cases. Other countries have laws and ordinances that are in most instances not superior to ours, but they have also the means to enforce them. Insufficient inspection is the weakest point in concrete construction in this country, while European countries have a larger number of government or city officials, which enables them to exercise better control. We have to adapt ourselves to our peculiar conditions, and have to add to the building codes of other countries a number of laws which especially protect those features of the construction from which disaster is most liable to result, that is to say, columns and piers. For this reason I have insisted in my paper upon discontinuing the use of all such methods of reinforcing as do not offer sufficient security, or in other words, I have suggested that of two methods which answer the purpose only that one should be allowed which offers a maximum security and gives ample warning of coming disaster; and on account of the scarcity of trained building inspectors and the lack of testing stations at which the necessary tests would have to be made by the inspectors, I have advocated to compel the contractor to make the tests

himself, and to have him provide the proper testing machinery.

A written discussion of the paper was received by the Society from Professor A. N. Talbot of the University of Illinois who very favorably commented on Dr. Michaelis' paper. Professor Talbot fully supported the views of the speaker with regard to the necessity for continuous tests and pointed out that tests for direct compression alone would not be sufficient in every case, but that it would be necessary to make tests of plain concrete beams, as suggested by Dr. Michaelis, in order to arrive at the real value of concrete to be used for beams and floor slabs. Professor Talbot likewise emphasized that such tests should be made compulsory.

Mr. Peter Bartzén, the commissioner of buildings of the City of Chicago, has requested Dr. Michaelis to go into details and to suggest changes of the present building ordinances and additional ordinances for concrete construction. We understand Dr. Michaelis is preparing a report for the commissioner of buildings which we hope will become the basis for building laws that will make concrete construction a safe enterprise.

RECESSION OF NIAGARA FALLS.

The wearing away of the rock at Niagara Falls is much greater at the Horse Shoe Falls than at the American Falls. From 1827 to 1905 we give the following data: From 1842 to 1905 covering a period of 63 years the recession of Horse Shoe Falls has been 5 feet per annum or 315 feet, while the recession of the American Falls, from 1827 to 1905

covering a period of 78 years was less than 3 in. per annum or 19 ft. 6 in., during the 78 years. The power development companies who take water from above the falls and discharge the same below the falls, will lessen the erosion in the future, and if restrictions are not imposed on these companies the water of Niagara river will be almost entirely diverted for industrial purposes in time.

ENTIRE REINFORCED CONCRETE OFFICE BUILDING, GLASGOW, SCOTLAND.

Abstracted from Builders Journal, London.

Lion Chambers, Glasgow, Scotland, a large 8 story office building constructed of reinforced concrete covers a building site 46 ft. by 33 ft., was erected without outside scaffolding or power hoists all material being hoisted by hand labor. Each floor being completed before the walls of the next story was commenced, the outside work being done on flying scaffolding cantilevered off of each floor.

The centering was the customary Hennebique system. The false work for the octagonal cupola on the roof was formed by uprights accurately cut to the contour required as shown in Fig. 2. The decorations such as key stone busts medallions were formed in plaster molds reinforced with steel, either in place or cast on the floor and afterwards fixed in place.

The roof is entirely constructed of reinforced concrete, and the concrete has been covered with a bituminous material to ensure watertightness, with the exception of the

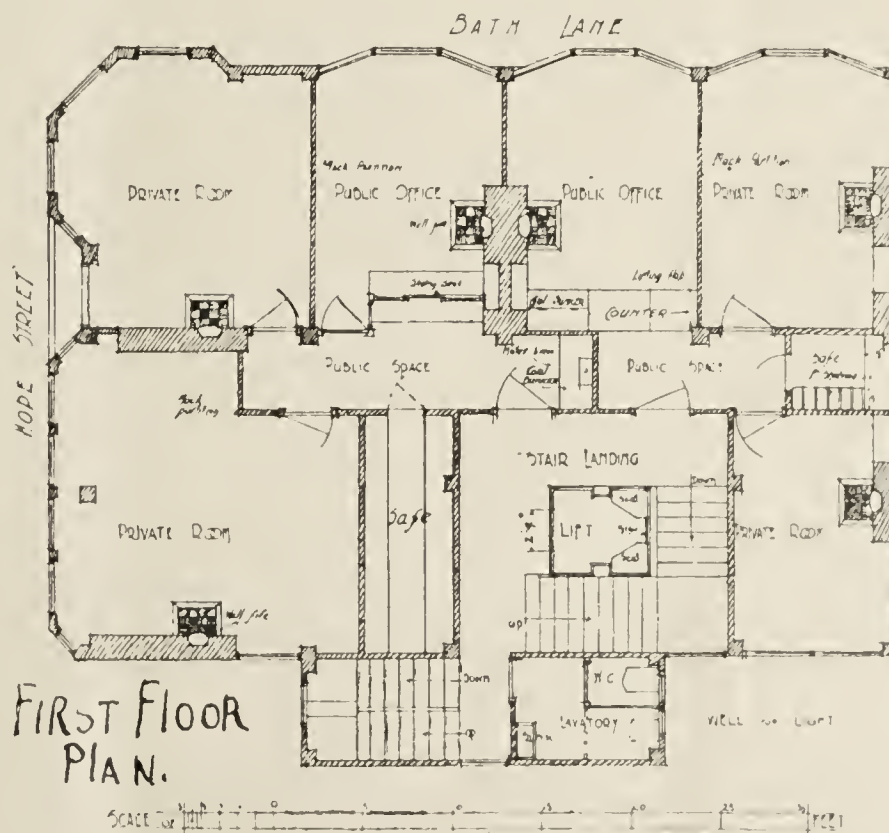


Fig. 1.

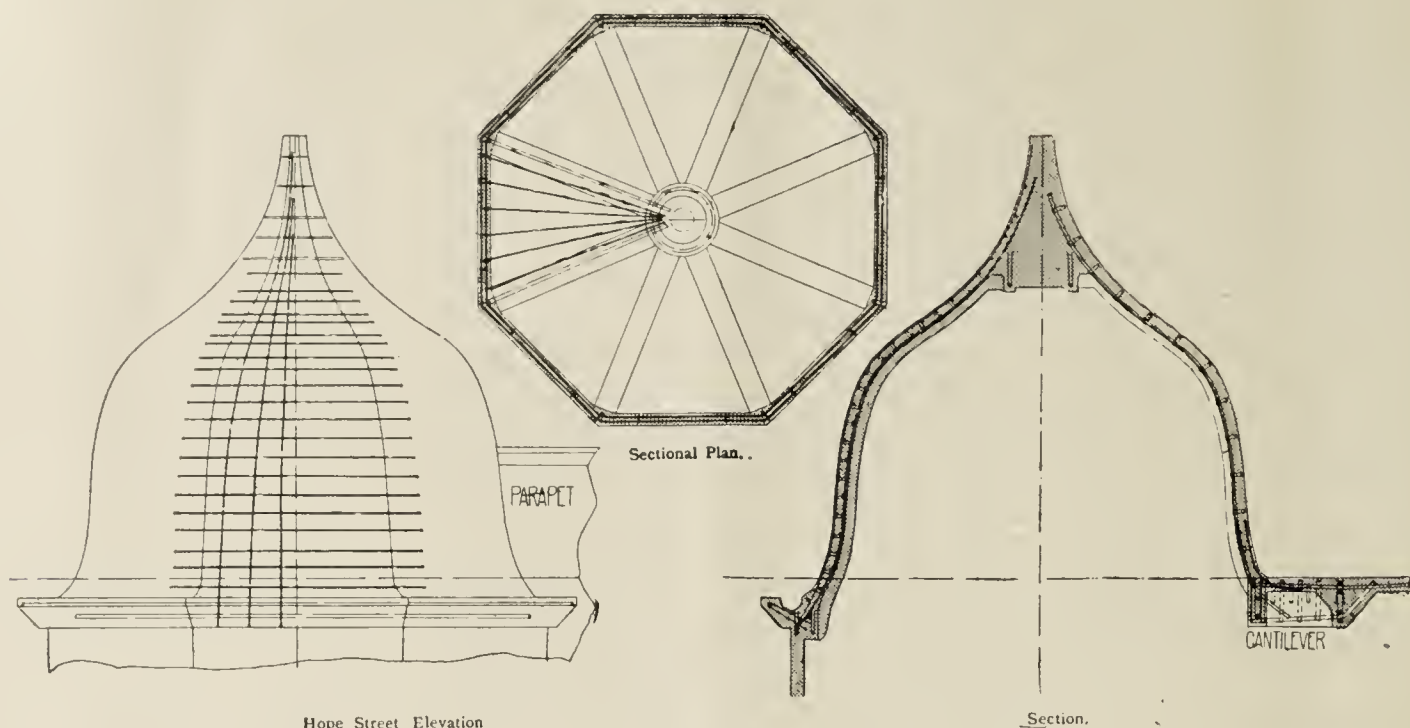


Fig. 2.

cupola and the steep-pitched portions of the roof, which were simply rendered on the exterior with cement mortar, and have since proved water-tight.

All of the concrete was mixed by hand, the outer walls are 4 in. thick. No effort was made to imitate natural stone; the natural concrete finish being left as it came from the hands of the workmen. Fig. 1. is a ground floor plan of the building. The illustration on our front page shows the building as completed.

TO BUILD A NEW U. S. PRISON.

By a recent order of the Secretary of War a new government prison is to be built on Angel Island in San Francisco Harbor. This will mean the abandonment of the old military prison on Alcatraz Island. It is stated that the old prison on Alcatraz, which has been there for about sixty years, is poorly constructed, too small, and generally unfit for the purpose to which it is devoted.

The location of the new prison will be determined partly by the extent of the water supply. It will be a large building, the ultimate cost of it being over \$250,000. It will accommodate more than 1,000 prisoners, from the entire Pacific Coast, including Alaska and Philippines, Indian prisoners and others, many of whom are now in the county jails and state penitentiaries.

Angel Island, which is only a few miles from Alcatraz, includes nearly 1,000 acres. It abounds in stone which is of excellent quality for building purposes. The new building will be constructed of concrete and stone strengthened with structural steel. It is the purpose of the War Department to have the most

of the work, especially the quarrying of the stone, done by the prisoners now confined in the old prison on Alcatraz Island.

Active work on the new building will be commenced just as soon as the money appropriated by Congress is rendered available.

J. MAYNE BALTIMORE,
San Francisco, Cal.

INFERIOR CEMENT AT PORTLAND, OREGON.

City Engineer Taylor, of Portland, Ore., says much inferior cement has been dumped upon the Pacific coast market, due to the great scarcity of cement. For a time there was no good cement available. Dealers were compelled to handle inferior brands. Much of this cement unloaded at Portland has gone into private contract work. The result of this has been seen in several instances where the mortar has crumbled before the buildings have been finished.

As the city engineering makes careful test of all cement used on public work, no bad cement has passed city inspection. The city laboratory record show that one lot of cement may show up first class; another lot under the same brand will be inferior, necessitating thorough and constant testing.

This was recently exemplified by making tests of a brand of cement known as the Superior German Portland cement, a consignment of which was recently placed on the Portland market. The first test fell just under the requirements, so the city engineer concluded to permit the cement to be used on public improvements pending another test. The second test resulted favorably, but a third test was entirely unsatisfactory, the tensile strength being

only 7 pounds to the square inch.

Among the brands of cement tested and graded as inferior are the following: The Anchor, Eagle, Eddystone Lighthouse, Elaine, Royal, Osaka, Onoda, Chewo and Chuo. The last four brands of Japanese cements have recently been placed on the accepted list by the city engineer, including the Asona, Alchi, Kokasado and Nippon.

Other brands of cement which have been accepted by the city engineer are the Alsen, Jossen, Dragon, Fortifi-Ideal, Pacific, Port of Portland, Fortification, North Condor, Heiderberg, Germania, Atlas, Western Cement Co., Anna, Elsa, Haccourt, K. B. & S., Kansas, Scale and Ship.

A number of tests of recent consignments recently arrived in Portland are now being made. It is said that a larger amount of good cement is now on the market than for some time past, but there is still considerable room for improvement.

ALABAMA CEMENT.

Demopolis, Feb. 25.—L. C. Lane, one of the civil engineers engaged in the construction of the locks on the Tombigbee and Black Warrior rivers, reports that the work is being prosecuted with determination, and that in time the plans outlined will have been carried out and that the coal and iron district will receive no little benefit therefrom.

Mr. Lane is interested in the manufacture of cement in Alabama, and says that the prospects are bright. Especially in the vicinity of Demopolis, he says, is there great opportunity for development in cement. The works at this place are doing well, but their capacity is not very large. The government work on the rivers between the Birmingham dis-

strict and the Mobile Bay is requiring large quantities of the product, and the goods manufactured in Demopolis and elsewhere in Alabama, says Mr. Lane, is coming up to the requirements right along.

Mr. Lane is of the opinion that Alabama can supply its share of the cement for use in the construction of the Panama canal and, with water transportation, the competition of the entire world could be overcome with a price that would not only give a good profit to the manufacturers, but would also be a saving to the government.

ECONOMY OF PRODUCER GAS PLANT OVER STEAM PLANT.

For each 1,120 heat units developed in the fuel under a boiler furnace 224 units are lost in radiation. Flue gases and clinker, ashes, while 896 units are present in the steam, from which 112 units are lost in the pipes connecting the boiler and engine, leaving 784 units supplied to the engine, of which only 117 heat units are converted into power, 667 heat units being lost in the exhaust steam, while 17 units are consumed by friction in the engine, leaving only 100 heat units that are converted into useful work. Out of the 1,120 heat units produced under the boilers, for a 250 H. P. plant upon which the above data has been computed.

In a producer gas plant to develop the same power, there is a greater saving of fuel, as only 525 heat units will be required at the generating plant to yield 100 heat units usefully applied, in the producer gas plant engine only 105 units will be lost in radiation and 126 units in cooling the engine, 117 in exhaust, leaving 117 applied in useful work, resulting a saving of 53 per cent, in favor of the producer gas plant. In a 40 H. P. plant the producer plant gave a saving of 70 per cent over steam. The above data is an abstract from an article in the Scientific American.

N. L. Brown of Chicago, dealer in Cement & Coal has filed a petition in bankruptcy, assets \$4,688.79; \$3,330, secured; liabilities \$3,967.30.

The Empire Portland Cement Company after making to the extent of \$35,000, is preparing to start up with a capacity of 800 barrels per day, or 175,000 barrels for seven months run. The output for the season has been about sold. 120 men will find employment. The plant is gradually to be brought up to 1500 barrels per day.

FIRE IN A CONCRETE BUILDING.

A fire occurred in the 8 story reinforced concrete building on the corner of Prince and Concord sts., Brooklyn, N. Y., occupied by Thompson & Norris, manufacturers of paper goods, such as corrugated paper and ground cork covered paper used to protect fragile ware during shipment. The seventh floor of this building carried large quantities of cork shavings and refuse, and other material, which caught fire. When the firemen arrived they thought they could control the flames in short order, twenty minutes later a second alarm was given for more engines. Chiefs Sully & Duffer in charge, the valves on the 7th floor become red hot. All of the stock was consumed as well as the wood work.

There were several hundred operatives employed in the building and some of them were women. They had great confidence in the structure, apparently, for they declined to be panic-stricken, and the women walked out of the building, down the stairs in a most leisurely way, and some of them stopped on the lower floors and looked out of the windows at the men in the street. And pretty soon there was a cataract flowing down the stairs and escape in that way was cut off for persons who did not care to have their feet and ankles wet. There was some seepage of water too, from the seventh floor to the floor below and that caused some damage to the stock there, but most of the water on the floors below the fire flowed in from the stairways. This the firemen declared to be a fault in concrete buildings. They cannot hew holes in concrete floors with their axes, that the water may escape, and it has to flow out by way of the staircases and the elevator shafts. Some of the observant firemen thought some man in the future would make a fortune by inventing some kind of wall sluiceway that can be opened to the outside of such buildings to permit water to drain off, without spreading over the floors below.

The firemen said the walls were so extremely hot that it converted the water thrown against them into great clouds of steam, preventing effective work. Not until the walls were cooled off could the fire be extinguished.

The flames were mastered after a long fight, and they were confined, as has been said, to the floor on which they originated. The damage as estimated is placed at \$9,000,

with \$7,000 of that to the stock and \$2,000 to the building. And the loss on the building was mainly on the interior fittings of wood. The concrete being practically uninjured.

SELLING CEMENT BY WEIGHT.

The Canadian Society of Civil Engineers, at their last annual convention held at Montreal, in January, took strong grounds in favor of selling Portland cement by weight, rather than by the barrel or sack, as these packages vary in weight as much as 50 pounds to the barrel. The society has appointed a committee to secure legislation to regulate the sale of cement by actual weight only.

The railways of the United States consumed 84,000,000 wooden ties in 1905, requiring 300,000 acres of timber to supply this number of ties each year.

Maurice Halloran, the owner of a large stone quarry near Decorah, Ia., is trying to interest capital in a Portland cement plant at Decorah.

The Crescent Cement Company's new plant at Wampun, Pa., is to have daily capacity of 3,000 barrels per day. The power plant will have a capacity of 3,000 H. P.

The Peerless Portland Cement Company has been rushing repairs before starting up, in expectation of an early opening of the season.

The Georgia state fair, to be held at Atlanta in October, will have a special exhibit of concrete products. An entire building will be devoted to this exhibit, the object being to show the people of the South the rapid progress and development of concrete construction and concrete products. Concrete machinery will be shown in operation. It is expected that concrete will form one of the largest exhibits at the fair.

Cement shipped to Costa Rica, in steel drums is preferred on account of the moist condition of the air during a greater portion of the year on the coast. Cement in wood rapidly deteriorates. German and Belgium manufacturers are the only shippers in steel casks and therefore have the Costa Rica trade.

The output of the Colorado Portland Cement Co. for 1907, is to erect 750,000 barrels and 30,000 tons of wall plaster.

PRODUCTION OF CEMENT IN 1906.

The production of cement in the United States for 1906, was as follows:

Portland cement, 45,610,822 barrels, valued at \$51,240,652.

Natural Rock Cement, 3,935,275 barrels, valued at 2,362,140.

Puzzolan Cement, 481,224 barrels, valued at \$412,921.

The grand total of all kinds of hydraulic cements produced was 50,027,321 barrels, valued at \$54,015,713.

The total production for 1905 was 40,894,308 barrels, valued at \$36,012,189. The increased output for 1906 over that of 1905 was 9,133,013 barrels and \$18,003,524 in value.

A small fractional element at Union City, Mich., has been friendly to the Peerless Portland Cement Company, which distributes \$100,000. in wages annually.

The fair minded citizens in order to show their good will for the Company, have nominated an officer of the Cement Company for village president. All other men on the ticket were selected because they were friendly to the company. No opposition ticket will be placed in the field. Therefore the Peerless Cement Co., will rule the village in the future.

THE PRODUCTION OF GOLD AND SILVER IN 1905.

The United States geological survey reports the production of gold in the United States for 1905 as follows:

Gold, 4,265,742 fine ounces, valued at \$88,180,700, being an increase of 373,262 fine ounces and \$7,716,000 in value.

Silver, 50,101,600 fine ounces, valued at \$34,221,976, being a decrease of 1,581,200 fine ounces and an increase in value of \$765,952, due to the rise in value of silver of 4 cents per ounce over the previous year. Colorado was the largest producer of gold, the output being 1,243,291 fine ounces, valued at \$25,701,100. California was the second largest producer, the output being 928,660 fine ounces, valued at \$19,197,100. Alaska was the third largest producer, the output being 722,026 fine ounces, valued at \$14,925,600. Texas was the smallest producer, with an output of 92 fine ounces, valued at \$1,900.

The Grand Rapids Plaster Co. will erect a \$50,000 plaster mill west of Grand Rapids, Mich.

CORRECTION RELATING TO MACHINERY CONTRACTS.

In our February issue, page 50, under the caption of "A Cement War to be Waged," we stated that the Allis Chalmers Company had secured the contract for all the cement machinery and electrical equipment of a modern cement mill for the Henry Cowell Lime and Cement Company. This is an error, inasmuch as the entire equipment of ball mills for this plant are Krupp Ball Mills furnished by Thomas Prosser & Son, of 15 Gold street, New York. We are informed that the rotary kilns and driers was furnished by other parties than the Allis-Chalmers Company.

The Allis-Chalmers Company of Milwaukee is furnishing the crushing, drying and grinding machinery and the coolers and kilns. The latter are 8 feet in diameter and 125 feet long.

The officers of the company are: I. M. Yost, President; S. P. Kramer, Vice-President; Erasmus Haworth, Secretary, and J. H. Ward, Treasurer. The main office is in the Dwight Bldg., Kansas City, the Western office at Hays City, Kan., and the works, as before stated, at Yocemento, Kan.

It is expected to begin operation of the mill by October 1st of the present year.

INCORPORATED.

The Eureka Machine Company, to manufacture concrete mixers; H. F. Harper, president; H. Abbott, vice-president; Frederick Mosher, secretary and manager, and J. Hopkins, treasurer, filed articles of incorporation at Jackson, Mich.

The Portland Stone Company of St. Paul, Minn., has closed a contract with the city for building 500 feet of reinforced concrete conduits to replace wooden conduits, the contract price being \$3.50 per lineal foot. Last year's contract for \$3.50 lineal feet of the same kind of pipe was let at \$2.85 per lineal foot, the increase of 65 cents per foot being due to increase cost of labor and materials.

The McIntyre-Ball Concrete Machinery Co., of Detroit, Mich., to manufacture cement building material with an authorized capital stock of \$15,000, of which amount \$15,000 has been subscribed, \$1,500 being paid in cash and 13,500 in property.

Ind. Cement Construction Company, Bloomington, capital \$10,000. Directors, H. A. Axtell and J. W. Axtell. ‡

The Stoner Cement Post Company, of New Albany, Ind., has filed articles of incorporation with the secretary of state. The capital stock of the company is \$8,000, and the incorporators are Lewis H. Stoner, Robert F. Brammer, W. E. Barlow, Charles W. Martin, L. R. St. John Thomas Booher and David Kaufman.

The Wallis Concrete Company of Houston, capital stock \$100,000; incorporators, A. M. Kellett, W. D. Majors, T. I. Wallis, T. K. Fulton, Fred Holcomb.

Kings Rock Cement Co., of Portland, Me., to manufacture cement. Capital \$750,000. J. E. Mauler, Pres.; C. D. Fullerton, Treas., both of Portland, Me.

Akron Stone Co., Akron, Ind., to manufacture Cement blocks, cement posts, vaults. Capital, \$10,000. Elizabeth Tatman, Edwin Landis and Geo. Royer incorporators.

The C. Hafer Lumber Co., of Council Bluffs, Ia., has increased its capital stock to \$250,000. The cement block department will be greatly enlarged. New machinery will be installed.

The Cheyenne Cement Stone and Brick Company will enlarge its plant. They want an experienced manager. The capital stock company is \$10,000.

The Interstate Limestone Company, of Youngstown, a new concern with a capital of \$75,000, will take over the limestone quarries of the Mahoning and Beaver valleys. It is composed of the owners of practically all the quarries of that section. Interested in the project are Robert Bentley, of the Osio Iron & Steel Company; J. G. Butler, of the Brier Hill Iron & Coal Company; Charles M. Crook, of the Bessemer Limestone Company; George W. Johnston and Charles Johnston, the largest quarry owners in Lawrence County.

The Hecla Cement & Coal Company is clearing out its coal mine, which was shut down at the time of the failure of the old company. The mines gradually filled with water, which is now being pumped out. From 500 to 600 tons of coal per day is to be mined in the near future.

A judgment of \$1,500 was awarded to Janet Linden against the Trussed Concrete Steel Company "Kahn System" on account of her husband being killed in a building under construction by the company at Toronto, Ontario.

PROPFE TUBE MILL.

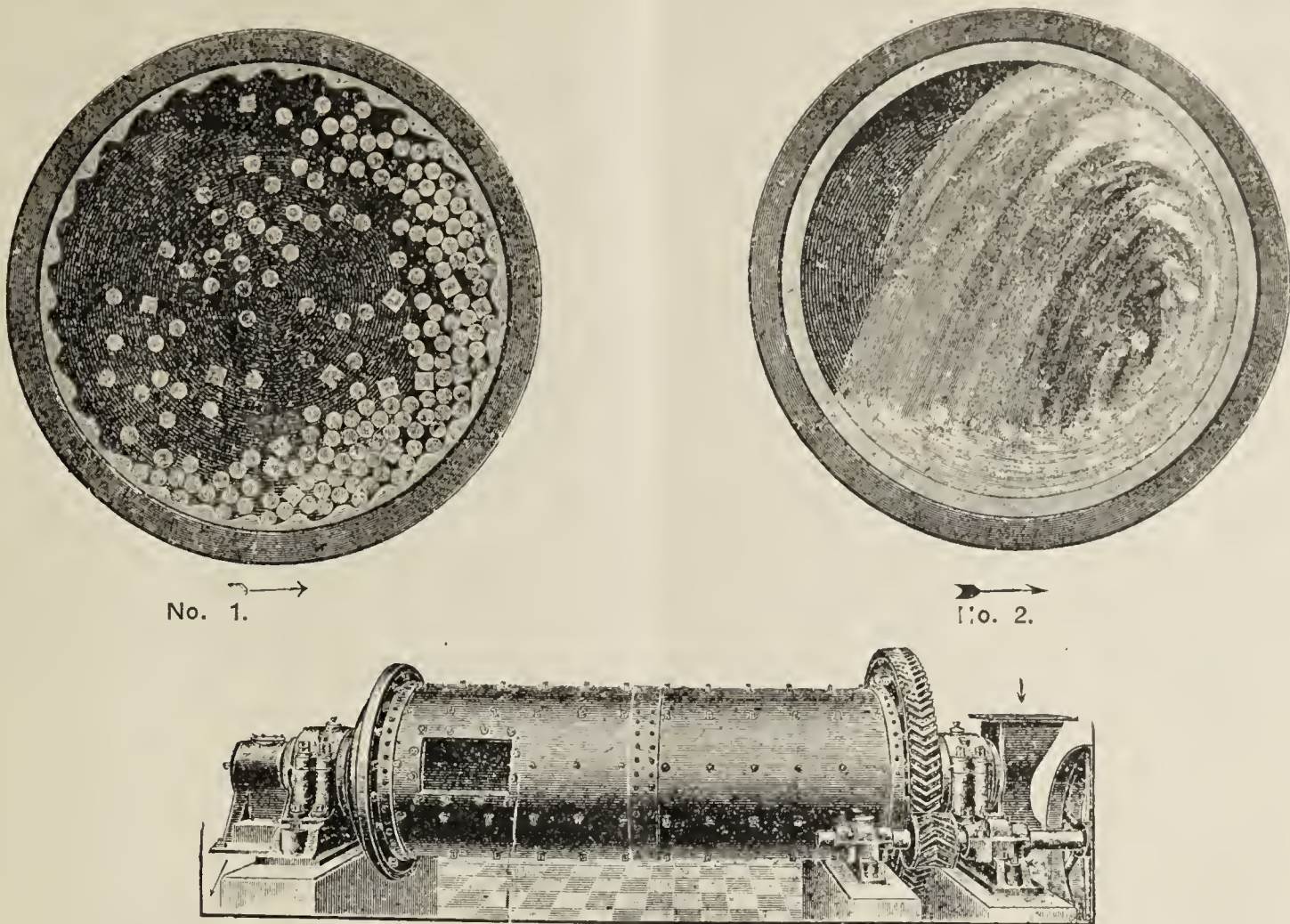


Fig. 3.

The Propfe Bros. Machine Works of Heldsheim, Germany, have placed a novelty in tube mills on the market, in which pebbles are displaced by square and round iron bars. Two views of the cross-section of this mill are shown in our illustrations. Fig. 1 shows the bars in motion. Fig. 2 shows the mill charged with material in motion. The arrows indicate the direction of rotation of the mill, which has a cor-

rugated steel lining. Fig. 3 is a cut of the mill. The arrows indicate the feed and discharge. The manufacturer claims equal efficiency with the pebble mill.

tion of this mill are shown in our illustrations. Fig. 1 shows the bars in motion. Fig. 2 shows the mill charged with material in motion. The arrows indicate the direction of rotation of the mill, which has a cor-

NEW COMPANIES.

The Trussed Concrete Steel Company of Canada, Limited, Walkerville, Ont., incorporated, capital \$200,000. Directors, G. Kahn, D. C. Raymond and C. L. Wiman.

Mr. Chas. Allis, of Milwaukee, will erect a large reinforced concrete store and factory building, 154 feet front, on Green street between Randolph and Washington boulevard, to cost \$100,000. The building will be occupied by the Chicago Belting Co.

Chicago Concrete Machinery Company, Chicago; capital stock, \$30,000; manufacturing; incorporators, F. A. Peterson, F. A. Miller and E. R. Ede.

The Akron Stone Company, of Akron, Ohio, will soon ask for bids for the construction of a large plant for the manufacture of cement building blocks posts and cement burial vaults. Elizah Tatman, president.

The Kansas City Portland Cement Company is ready to start up, as about all the machinery is installed.

Rockwell City, Iowa, will have a cement sidewalk tile factory.

Ricker A. Papke, Concrete Block Factory Company, 4004 Lyndale avenue, Minneapolis, Minn.; capital, \$2,500.

Messrs. Hay & Peabody, of Old Town, Me., are manufacturing cement burial vaults.

Decatur Concrete Company, Decatur, Ill.; capital, \$2,400; manufacturing; incorporators, George Robb, David Hosteller, H. Edward Blohm.

CARE AND PRESERVATION OF FIRE HOSE.

The following instruction for the care and preservation of rubber and cotton covered hose were given at the last annual convention of the International Association of Fire Engineers: Thoroughly clean and dry hose before placing on reels. Continuous dampness injures cotton fabric covered hose. Good hose is antiseptic. Rubber lined hose should be kept moist on the inside unless there is danger of freezing, as frozen hose is liable to crack in handling. All hose should have water pass through it several times

a year. Extreme cold deteriorates hose. Avoid dragging hose over concrete floors or other rough surfaces, as this wears the hose very rapidly. Avoid short bends in storing hose, and change the folds frequently to avoid permanent set. Avoid exposing rubber hose or rubber lined hose to hot dry air or sunlight. Hose so exposed should have water passed through it, at least once a month. A slight coat of kerosene will soften up hardened rubber hose and make it pliable.

SAN FRANCISCO BRICKLAYERS' STRIKE ADJUSTED.

The bricklayers' unions of San Francisco have been on the verge of a strike on account of a disagreement between themselves and the concrete workers' union. The bricklayers refusing to work on concrete buildings with cement workers. The bricklayers have finally yielded the point in contention and have decided to continue to work with the cement workers on all kinds of buildings, concrete or other construction, as they thereby will avoid imposing obstacles to the rebuilding of the city.

San Francisco.

CEMENT BUILDING FRONTS.

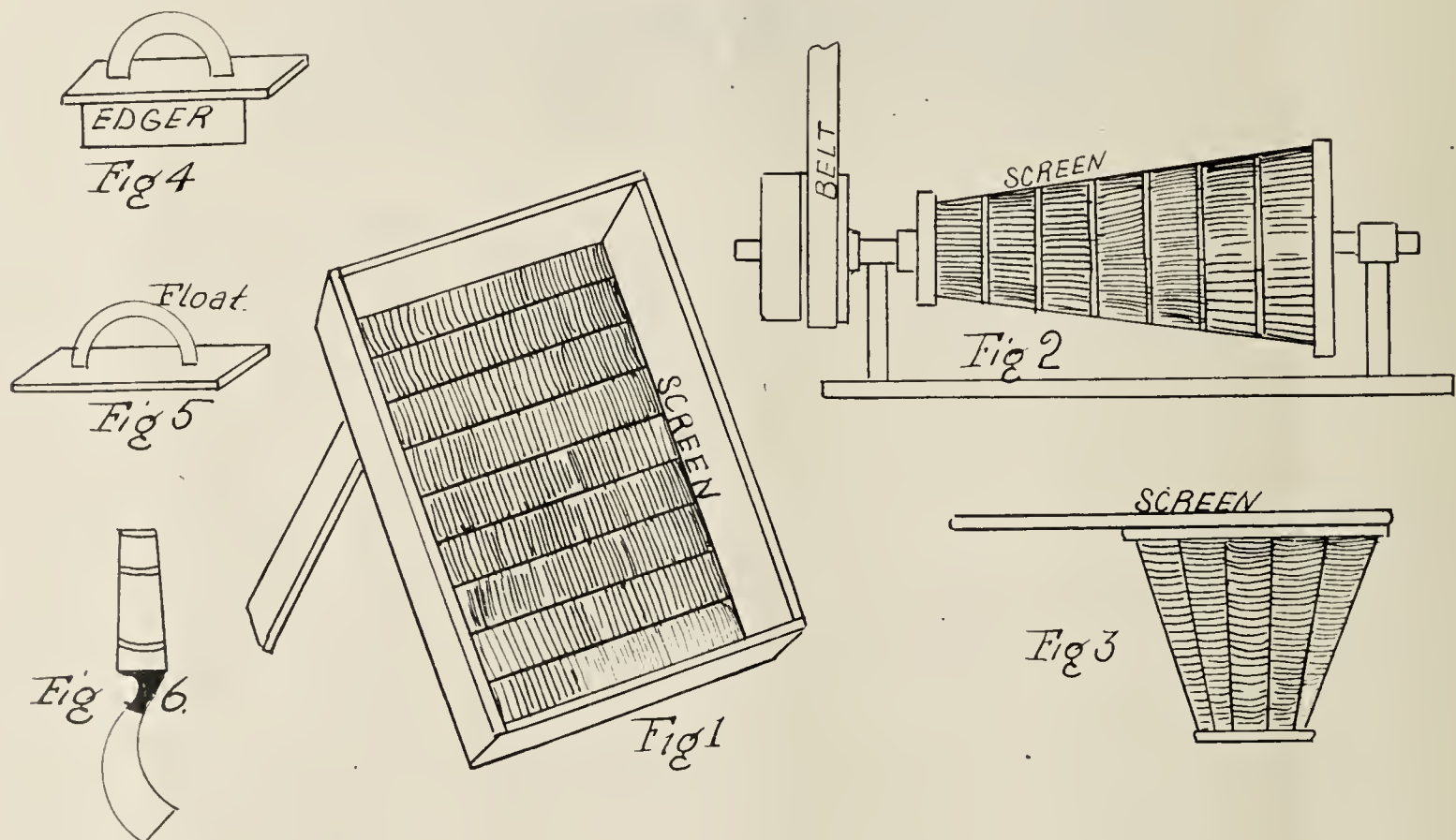
I notice that there are a great many cement buildings going up. In the manufacture of the material used in the erection of these buildings, Portland cement forms an important item. Usually one part of this cement to three parts of sand, and about five parts of gravel are used. In the screening of the material you will find that any of the forms of screens shown in the cuts will answer all purposes. The common flat body screen figure 1 is usually employed. It can be made with a wood frame with the wire screening nailed under the frame as shown. This frame is tilted to the proper incline for the working of the sand, gravel or other stock

only some frames to fill, and can be gotten at readily. On the other hand, there may be moulds to shape and the rammer will be needed. Then after filling and ramming you need your other tools for finishing purposes. You have your edger at hand for use, a view of which is given in figure 4.

Also the float figure 5 and the jointing tool figure 6. In the putting up of body concretes in the rough, some of the shaping forms exhibited next can be used. Perhaps there is need for line rollers. A line roller can be made as shown in figure 7. You can buy these devices in the supply houses, ready for use. Some men prefer to construct the contrivance themselves. The frame can be forged out of wrought iron

ings. Some of the designs contain in them several descriptions of materials. Colored glass is worked in some of the presentations. The body material being in a soft condition at the start, there is a possibility of introducing these portions and finishing off with an attractive design. Hence on some of the building fronts there are exceedingly elaborate effects resulting simply from the placing of foreign material in conjunction with the cement.

One of the forms for moulding the material is exhibited in figure 8. While some of these shaping forms are of metal, the majority are made of wood. The necessary details in the sections are cut with a saw and worked down with finishing tools. With the form properly modeled,



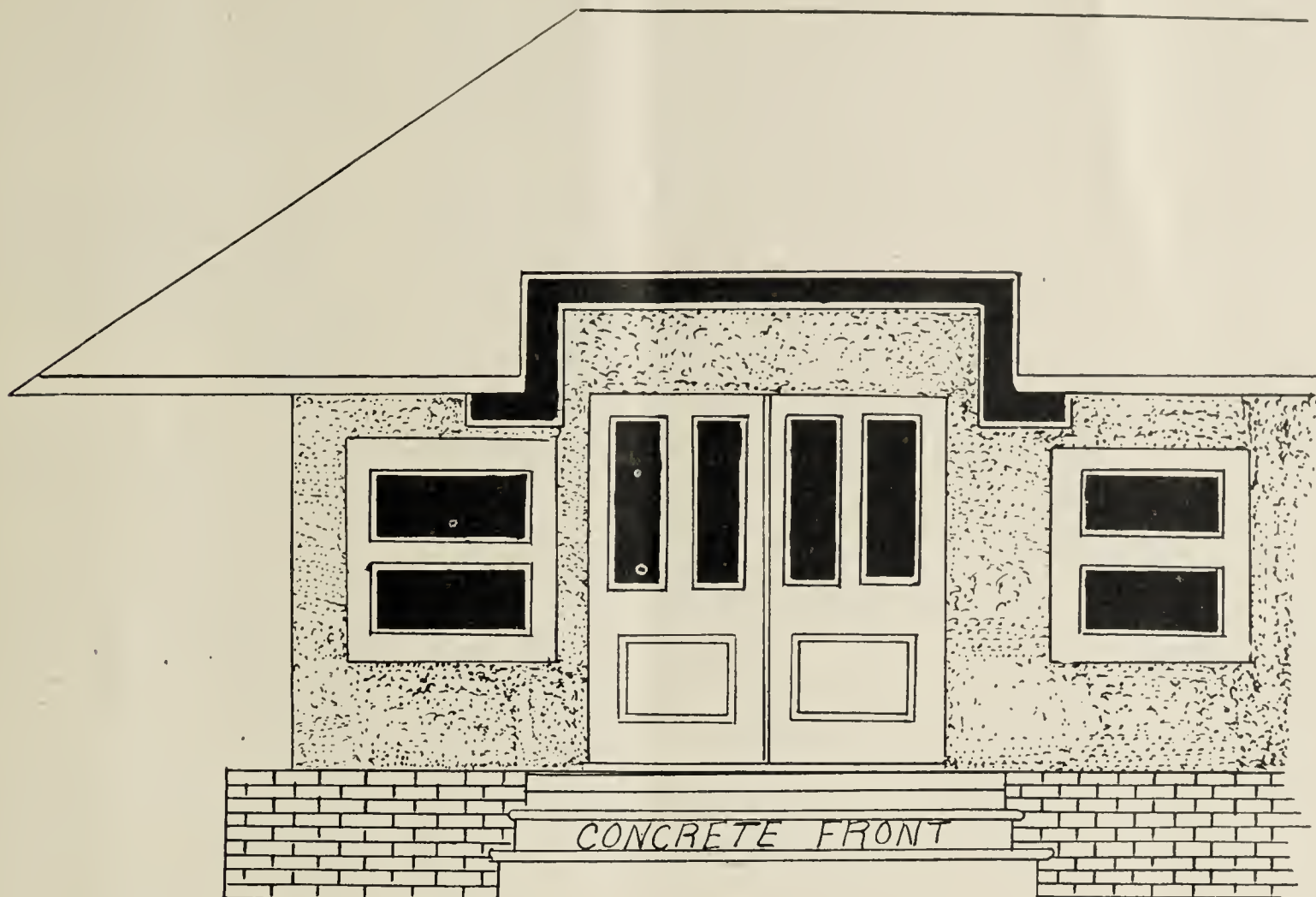
in hand. Sometimes a cylindrical screen is employed of the type presented in figure 2. This screen is made on a combination wood and steel skeleton. A shaft carries the whole thing in bearings. A tight and a loose pulley are provided for propelling purposes. Figure 3 is a light hand screen which may be used to advantage when sifting small lots of stock. The mixing is effected in troughs provided for the purpose until the material is even throughout. The stuff is made so that it will run readily from the metal wheelbarrow or other vessel if padded a little. Of course much depends upon the nature of the tamping needed. Perhaps there are

and a handle adjusted to it. The ends of the frame are flattened and bored for the shaft carrying the disks. These may be separate metal disks, and arranged for adjusting at various widths, or they may be cut solid in wood. Some men prefer to have a number of solid rollers in stock of various widths.

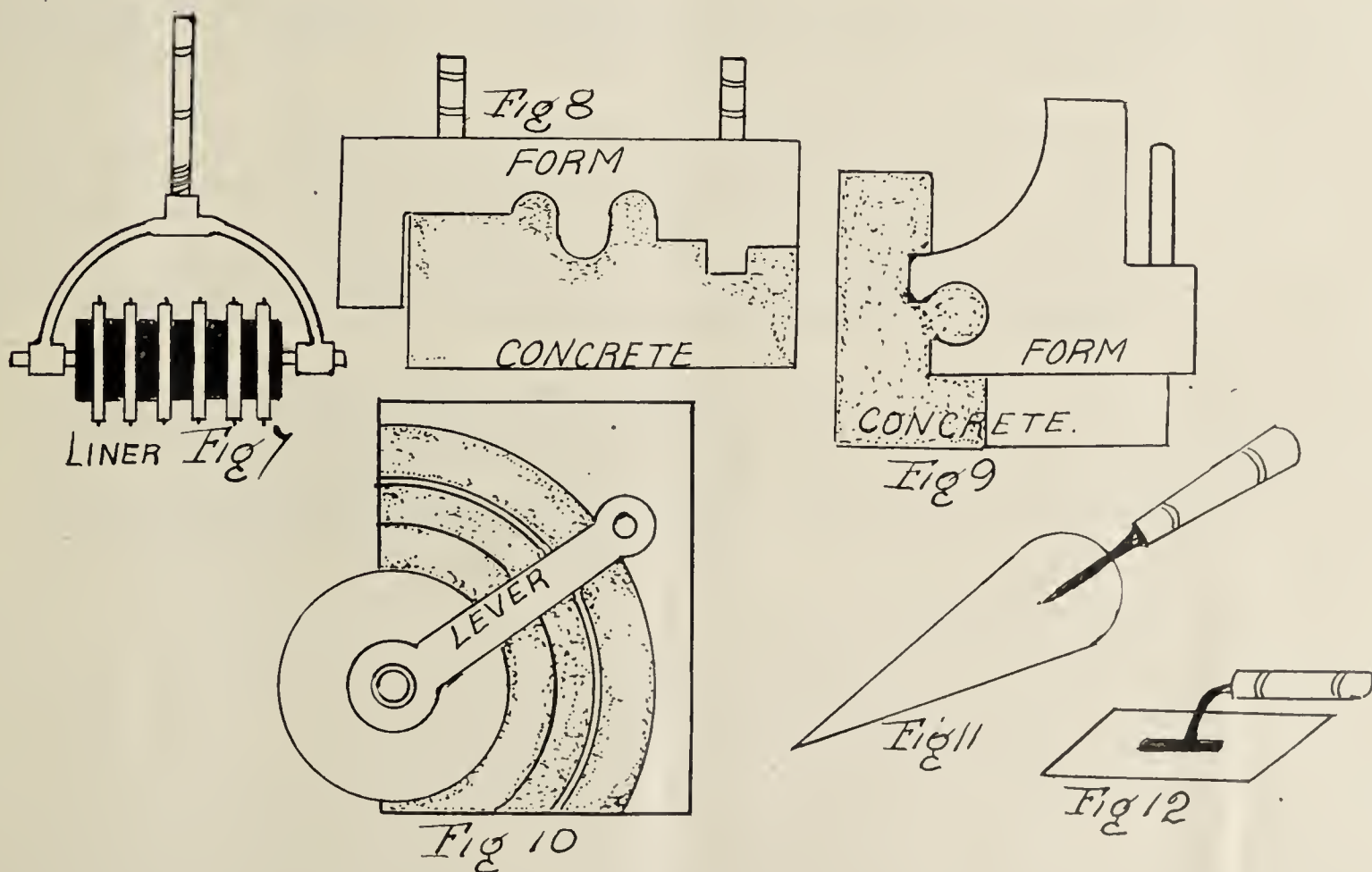
Some of the forms for getting the shapes of the designs on the cement sections are next shown. I notice that many of the cement buildings are made with combinations of wood and metal. In fact, brick, stone, wood, steel, etc., are used with very effective results in the designing and construction of some of the up-to-date patterns of build-

and the two handles set, the workman can mould considerable surface in a short time. In the finishing of the surfaces, if steel articles are employed too freely on the soft stuff, too much cement is brought up, and this forms a crust on the surface later on, and is liable to peel off.

If the form to be described involves a circular shape, the lever motion in figure 10 may be employed. Then again the form as in figure 9 is used, involving a pushing back and forward motion. Various shapes of trowels will be found useful, one form of which is in figure 11, the other in figure 12. The latter is essentially for smoothing purposes.



After you get your shapes executed, the powdering of fine cement helps a great deal. This absorbs the moisture. Look for dirty sand in making the mixtures, because discolorations will follow. Give the mixture a good trowelling to prevent pock marks as much as is possible. "R."



DEWEY POTLAND CEMENT CO.

The work on the factory of the Dewey Portland Cement Company, I. T., is progressing rapidly. Although the plant will not be completed and in operation until July 1st, next, the shareholders are very much elated at the progress being made, considering that since the work of building began last November, over 200 carloads of material have gone into construction of what is conceded by noted cement engineers will be one of the most complete and modern Portland cement plants ever built.

Throughout the plant, steel and concrete bins are being built with an aggregate capacity of 30,000 tons. This is in addition to the Finished Cement storage of 100,000 barrels.

The largest and most complete crushing plant together with immense steam shovels is expected to greatly reduce the cost of quarrying, in fact, the crushers being installed are larger than are now being used in any other cement plant, the main crusher having a capacity of 700 tons per hour.

All of the buildings will be constructed of steel and concrete. The power house is about ready to receive the engines and electrical apparatus, consisting of four 600 h. p. engines and one 75 h. p. also four direct connected 600 h. p. and one 75 h. p. alternating current generators. The foundations for all of the buildings, the immense concrete walls of the clinker storage and many of the machine foundations are already completed.

It is the intention of the engineers to always have one of the prime movers in reserve in case of breakdown of any one of the other three, which have sufficient capacity to furnish electrical energy for the fifty motors driving the plant. The plant in all of its details, will be the result of the best engineering skill and careful and reliable construction.

The property consists of 300 acres, 40 acres being the factory site, an adjacent 20 acres being platted on which have already been built modern residences and two hotels for employees. Natural gas mains, also an elaborate water system will serve the entire plant and townsite. The balance of the property, 240 acres, is of the very finest rock and shale deposits. The quantity and quality of these raw materials is absolutely determined by the sinking of shafts five feet in diameter and thirty feet deep, from which average samples were taken, the analysis showing same to be of the

very best cement material, according to the established formula for producing the highest grade Portland cement. The supply is sufficient for centuries. The quarries lying exposed on the hillside, will be free from water and therefore, no cost of drainage.

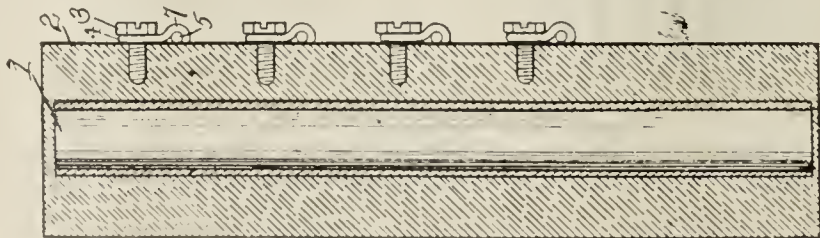
The steam shovels and the machine shop equipment is now being installed, together with the 75 h. p. gas engine and generator which is being used to operate four 15 h. p. motors, furnishing power for electric hoists, machine shop and concrete mixer.

The steel for the larger buildings is just arriving, and many cars of machinery will be shipped during this month.

The company has excellent railroad facilities, having direct switches from both the M. K. & T. and the A. T. & S. F., the latter being particularly strong throughout the far and middle West, while the former puts the company in touch with the South and middle West, thus furnishing adequate markets for the placing of the entire product the whole year.

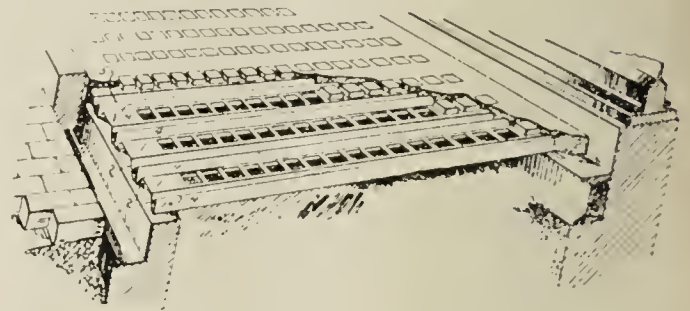
The Lake Field Portland Cement Company is to erect a plant at Montreal, Canada. The company placed an order for its electrical equipment with the Canadian General Electric Company, comprising three 1,300 h. p. transformers, two 2,000 h. p. transformers, one 20 h. p. motor, twelve 100 h. p. motors, eleven 75 h. p. motors, three 50 h. p. motors and three 10 h. p. motors, all complete with the necessary switchboard and speed controllers:

847,612. COMBINATION CEMENT AND METAL FENCE-POST. George G. Schroeder, Washington, D. C. Filed Feb. 28, 1906. Serial No. 303,377.



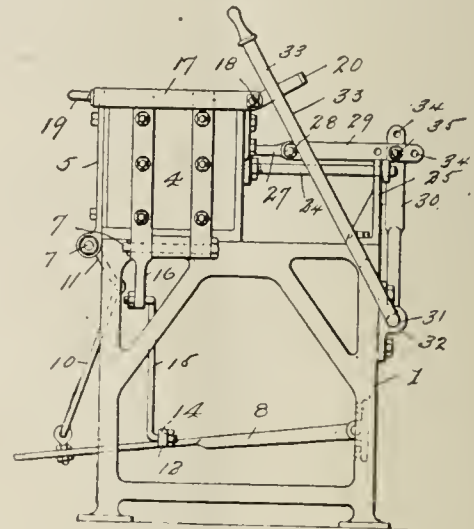
Claim.—A post of the character as described consisting of a metallic core and a coating of plastic material completely enveloping the same, a wire-securing screw adapted to enter the said plastic material, and a clip having an eye through which said screw passes, and a tang adapted to receive and bind the wire against the post.

847,700. SIDEWALK OF CONCRETE CONSTRUCTION. Julius H. Schlafly, Canton, Ohio, assignor to The Berger Manufacturing Company, Canton, Ohio, a corporation of Ohio. Filed Oct. 19, 1905. Serial No. 283,447.



Claim.—In a structure for a sidewalk or concrete construction, a series of apertures, transparent, semi-transparent or translucent blocks adapted to fit in the apertures diverging flanges located upon opposite sides of the tops and adapted to be connected together, substantially as and for the purpose specified.

647,764. CONCRETE - BLOCK MACHINE. Joseph H. Graham, Serial M14 N7A-D 18m? s—, Kempton, Ind. Filed Oct. 18, 1906. Serial No. 339,478.



Claim.—A concrete-block machine comprising a supporting-table, a level pivoted at its rear end to the rear portion of said table adjacent the floor and having its front portion projecting beyond the front portion of said table to afford a

foot-piece, a mold supported on said table and comprising a stationary rear wall and pivoted front and side walls adapted for outward swinging movement, said front and side walls having depending extensions beyond their pivots, a rigid link having at its upper end pivotal connection with the extension of said front wall, and at its

lower end pivotal connection with said level adjacent the forward end thereof, a cross-bar provided upon said lever at substantial right angles thereto, and L-shaped links interposed between said cross-bar and said side walls, each of said links comprising horizontal portions pivoted to the extensions of said side walls and perpendicular depending portions pivoted to the ends of said cross-bar.

THE UNCLE SAM PORTLAND CEMENT CO.

This company was organized in March, 1906. It is now constructing at Yocemento, Ellis County, Kansas, a modern cement mill with a daily capacity of 1,000 barrels of first-class Portland cement.

The location chosen for the mill site is immediately beside the right of way of the Union Pacific Railway, between Hays and Ellis, and between the railroad and a hill largely composed of chalk, limestone and shale. The property owned by the company covers 725 acres, furnishing abundant material for the uninterrupted operation of the mill for several hundred years.

The water supply will come from Big Creek, flowing at the foot of the hill, and will be abundant and of an excellent quality.

The two of Yocemento, already started, is a result of the formation

of the company and of the activity created by the building of the mill incident thereto.

The contract for the engineering and construction of the entire work has been awarded to the Freeborn Engineering and Construction Company of Kansas City, Mo., who began work about the 10th of March, 1907. The switches and sidings are already built and part of the machinery is already on the ground.

IOWA PORTLAND CEMENT CO.

The combined output of the Iola Portland Cement Co., consolidated, will have an output of over 18,000 barrels per day, as follows: Iola Portland Cement Co., 6,000 barrels; Dallas, 4,000 barrels; Kansas Portland Cement Co., 3,000 barrels; Eodosh, 15,000 barrels; Independence plant, 2,000 barrels; Mason City plant, under construction, 3,000; St. Louis Portland Cement Co., 1,800 barrels.

The Edison Portland Cement Company is to maintain an emergency hospital at the works and an ambulance. The money is to be raised by subscription among the employes of the works, the company agreeing to duplicate the subscription of its employes. There is at present no means of getting quick relief to men when they are injured, and owing to the accidents

at the works the project is a particularly commendable one.

FARMERS AND CEMENT SACKS.

Farmers using cement in sacks are complaining that they receive no credit when they return their sacks unless a second order is purchased, when 5 cents per sack will be allowed on sacks previously returned.

This being unsatisfactory the farmers are now keeping them and by careful dusting and subsequent washing, use them for roller towels, which are fringed and embroidered and thus become the favorite towels of the family. Writes one farmer in a local agricultural paper, by boiling in a strong solution of white oak bark, they are used for cushion tops. The circle printed on the face of the sack is worked into sun burst patterns by the proper needlework with colored yarn. If good fast colors are used in embroidering these cushion tops they will give good service for several years and can be made a thing of beauty and a joy for—as long as they last. In this way the farmer gets even with the dealer and is satisfied.

MEDUSA WATER-PROOFING

The Sandusky Portland Cement Company is furnishing Medusa Water-Proof Compound for use in the extensive concrete construction

DR. W. MICHAELIS, JR.

Consulting Engineer for the Cement Industry

Portland Cement Plants. Designed, Constructed and Superintended

Properties Investigated and Physical and Chemical Reports Made
Estimates on Cost of Erection of Plants and Manufacture of Cement

Established Plants Examined and Improved
Output of Kilns Operating on Wet Material Increased

Office and Laboratory: 1115-19 SCHILLER BUILDING, CHICAGO

work being done by the Standard Steel Car Co., of Hammond, Ind., where machinery foundation, elevator and belt pits are being water-proofed. They are also furnishing the Medusa Water-Proof Compound to Cranford & McNamee, of Brooklyn, N. Y., who are using it to water-proof concrete mortar in the rapid transit tunnelwork between New York and Brooklyn. The same material is being used in the New Olympic Club building at San Francisco, Cal.

Jas. E. Richard of Bloomsburg, Pa., has purchased a tract of land at Grovania, Montour County, Pa., with the view of erecting a cement plant thereon, according to local reports circulating in that vicinity.

The County Commissioners of Douglas County, Nebraska, have decided to replace all the temporary bridges with permanent steel or concrete structures. Omaha is the county seat of this country.

WANTED.

Young man chemist desires position in plant laboratory or plant superintendent's office. Address B. M., care Cement & Engineering News.

Cement engineer and superintendent who is also expert chemist, and graduate chemical engineer, with twelve years continuous practical experience in every department of cement manufacture, will be open for engagement shortly. Address care of Cement & Eng. News.

"P. C."

FOR SALE.

500 acres containing an inexhaustible supply of Lime Rock, Slate Shale and Clay on Mobile & Ohio R. R. one mile from station, suitable for locating a Portland Cement Factory.

For further information address
J. B. BROOKS,
Crawford, Miss.

WANTED.

Position as chemist in Portland cement. Have had splendid technical training. Can give best of references. Address "Hustler," care of Cement & Engineering News.

FOR SALE.

On account of changes in our coal grinding department we offer for sale 4 Griffin Mills, 30 Type "C," and 1 Clark mill, all in good condition. Also full line of repairs for same. A BARGAIN IF TAKEN SOON. PENINSULAR PORTLAND CEMENT COMPANY, Jackson, Mich.

PARTIES

Wishing to purchase the State rights of the Stevens patents for cast stone, known as litholite and roman stone, will please address,

URIAH CUMMINGS,
Akron, New York.

WANTED AT ONCE

Two Mechanical Draftsmen experienced in design of cement plants.

The Osborn Engineering Co.
Cleveland, O.

FOR SALE.

State or county license of a cheap process of making high grade granite imitation for building and ornamental work, fire and damp proof, magnesium floor and insulating work; colored inlaid cement floor and pavement tile. Address Julius Ruoff, care Cement and Engineering News.

WANTED

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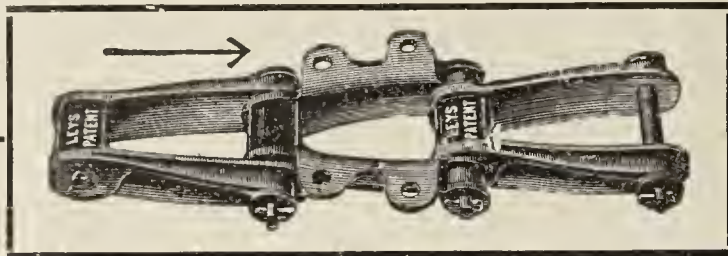
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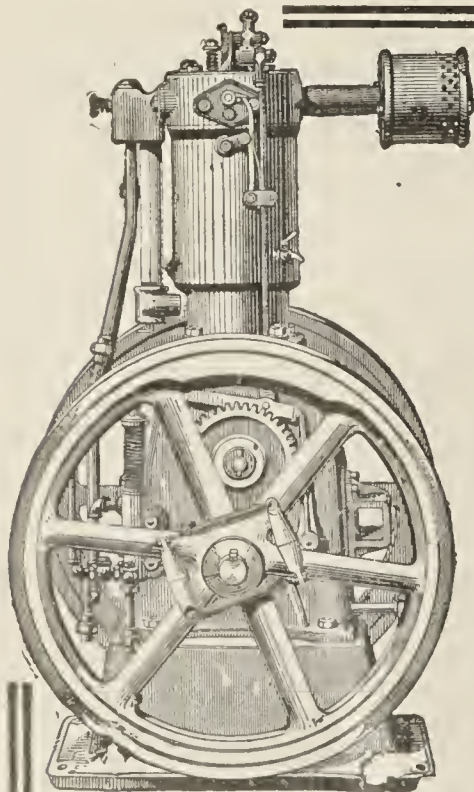
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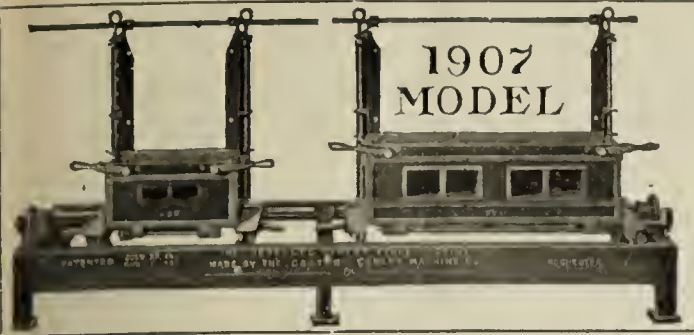
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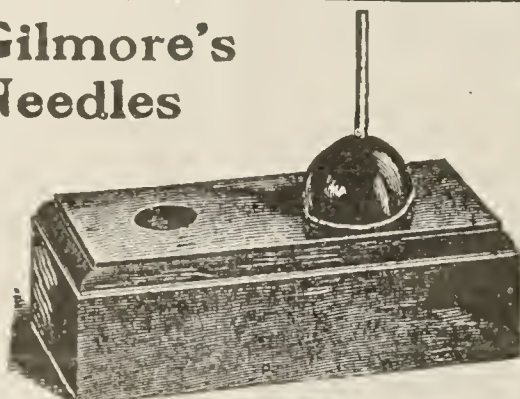
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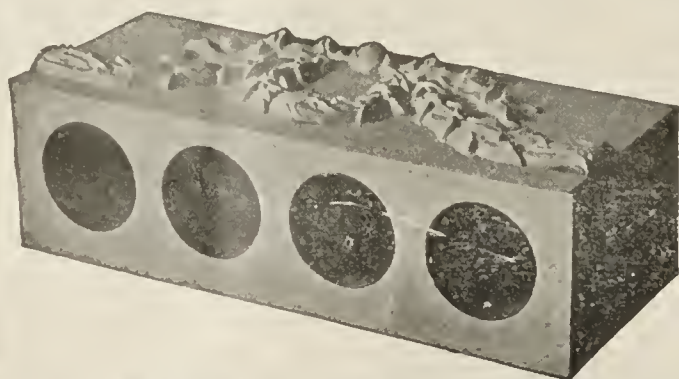
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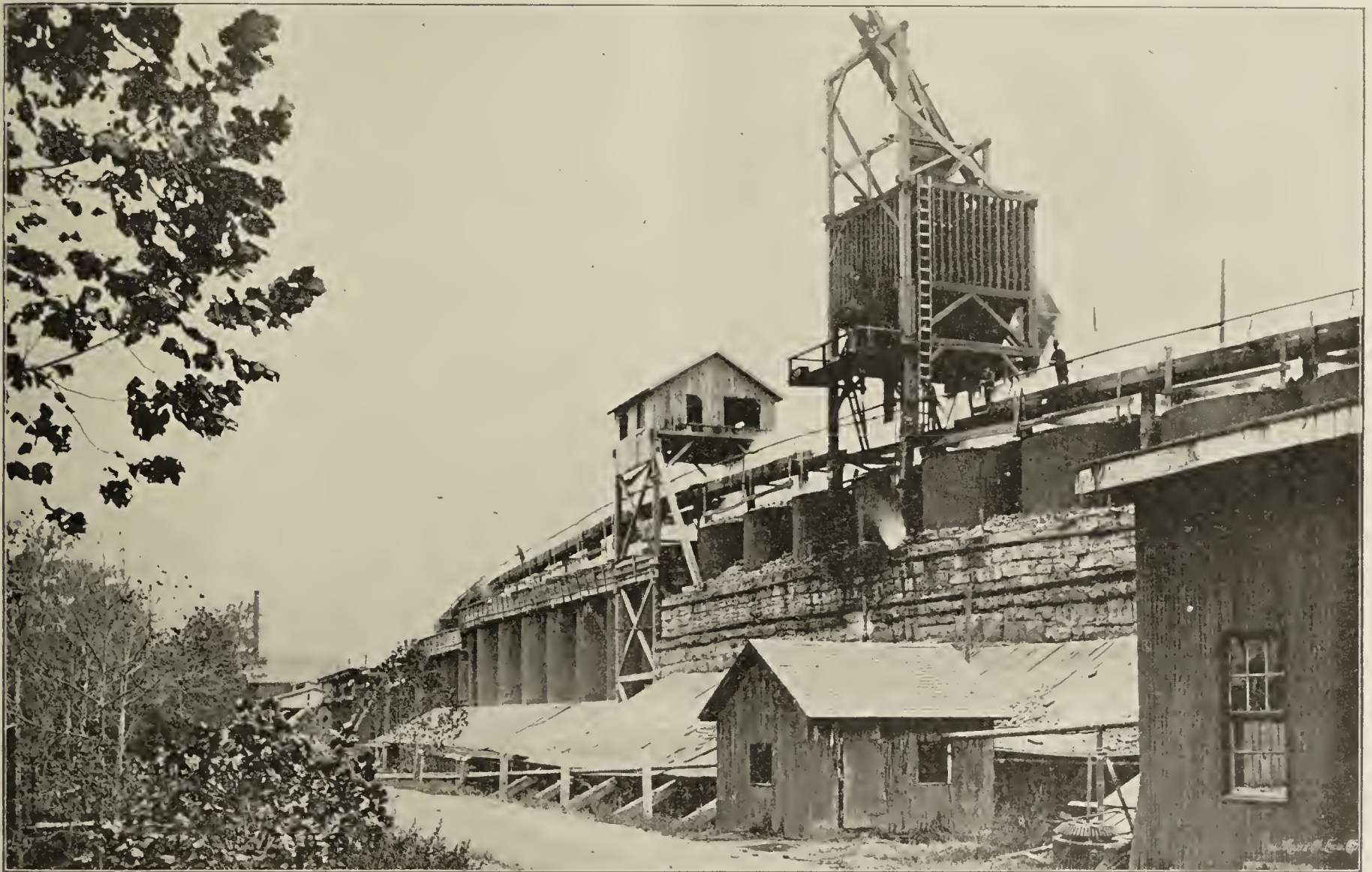
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CEMENT

.....AND.....

ENGINEERING NEWS



A BATTERY OF NATURAL CEMENT KILNS.

In the Louisville natural cement belt, the natural cement industry is on the decline, being displaced by Portland cement. Several mills in the East will continue to manufacture natural and Portland cement. Many contractors prefer brands made by mills that produce Portland cement only.

CEMENT AND ENGINEERING NEWS

(PUBLISHED MONTHLY)

WILLIAM SEAFERT, Editor and Publisher

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CHICAGO, APRIL, 1907.

CORRESPONDENCE.

We solicit correspondence on all matters of general interest to the cement trade in all its branches. Engineering notes, public improvements, and facts and opinions drawn from practical experiments will be welcome.

THE CEMENT INDUSTRY AND ITS POSSIBILITIES.

The demand for cement during the first three months of the year has been unusually brisk. Especially so in March during which the weather was mild and promised an early opening of the season. The demand has kept up strong. The only exception being in the territory centering at Pittsburg, where there was a falling off in prospective building construction during January, February and March of fully \$7,000,000 below 1905. In April, however, the volume of business in building construction opened up much stronger than for similar periods in either 1905 or 1906. The temporary lack of confidence has vanished. With the prospects of an unusually large volume of business during the rest of the season tributary to Pittsburg.

The railways of the country have cancelled or deferred contracts involving nearly \$100,000,000 construction work. Yet this does not seem to effect the demand for cement in other lines of construction. We expect prices will be firm throughout the season; that all the mills can grind will find a ready market, with constant upward tendency in price.

Within the next two years we expect to see a great change in cement manufacture. With existing installations the output will be

doubled. Fuel bills reduced and a kiln proof cement, hot from the mills, that will stand all the usual tests for soundness, will be the rule. Such a plant is now in successful operation in which a 60-foot kiln is capable of yielding 500 barrels of sound linker in 24 hours. This is an actual existing fact, not in the least over-drawn, or over-stated.

The car shortage prevailing in March has been relieved. Cement is now going forward to the satisfaction of the consumer.

INJUNCTION AGAINST CONCRETE BLOCK ORDINANCE.

The Memphis Granolithic Company of Memphis, Tenn., by its president, C. W. McDaniel, filed a petition for an injunction to restrain the city of Memphis and its building commissioner from enforcing that portion of the building code relating to the manufacture and tests of concrete building as provided in Section 1 to 23 of the ordinance. C. W. McDaniel in petition avers that concrete blocks manufactured in conformity with the provision of sections 1 to 23 of the ordinance, prescribing their size, will not stand the fire and water tests prescribed in section 24. This section prescribes that the concrete blocks are to be subjected to a fire test of 1,700 degrees Fahrenheit for at least 30 minutes, after which they are to be plunged into cold water of about 60 degrees temperature. They must stand this test without disintegrating.

Complainant claims to the court that no concrete block made under the specifications can stand these tests and that the ordinance discriminates against him and in favor of brick manufacturers. On these grounds the complainant asks for a preliminary injunction restraining the city officials from enforcing the ordinance, and that on final hearing it be made perpetual. Chancellor Heiskell granted a preliminary injunction against the city of Memphis and Dan C. Newton, building commissioner, restraining them from enforcing an ordinance passed by the legislative council of Memphis on January 10, 1907, amending the general building ordinance of the city, and prescribing the material and proportion of concrete building blocks and fire and water tests to be borne before they can enter into the construction of any building.

GAS IN SOUTHEASTERN KANSAS.

Gas has been discovered in 10 counties of the 105 in the state of Kansas. Its history and distribution in the Kansas-Indian Territory field are so closely connected with those of oil as to be almost inseparable. About the year 1860 the numerous shallow oil wells drilled to depths of a few hundred feet in southeastern Kansas yielded traces of natural gas as well as of oil. Twenty years later, gas in small quantities was found in a number of places near Independence. The first good gas well in the vicinity of Neodesha, which is now a center of production of gas as well as of oil, was drilled in 1893. The present production of gas in the Independence quadrangle is enormous. The value of the quantity now annually consumed in the quadrangle alone is estimated to be about \$800,000.

The Independence quadrangle is a rectangular area of about 950 square miles, situated in southeastern Kansas, adjacent to Indian Territory, its eastern limit being about 47 miles west of the Kansas-Missouri line. It forms an important part of the well-known Kansas-Indian Territory oil and gas fields, which have an area of nearly 11,000 square miles. The chief towns of the quadrangle are Independence, Coffeyville, Cherryvale, Neodesha, Caney, and Elk. The growth of these towns has been greatly stimulated during the last few years by the finding of oil and gas.

More gas sands than oil sands are encountered in the drilling of individual wells. This oil may be found above the gas or below it. The gas is believed to come mainly from depths of 1800 to 23000 feet.

Thus far most of the gas has been put to local use. It furnishes the light, fuel and power of practically all the cities and most of the farm communities and is extensively used for fuel in drilling and pumping. It also supplies the city of Parsons and its numerous industrial plants east of the quadrangle. All this, however, forms but a small percentage of the quantity consumed and to be consumed by the manufacturing industries which have grown out of this natural commodity. Of these industries the most important are those producing cement, zinc, and lead.

The Coldwater Cement Products Co., of Coldwater, Mich., has purchased six acres of gravel land, upon which the plant will be located. The plant will be operated by a 16 H. P. gasoline engine.

BEWARE OF IMITATION PORTLAND CEMENTS.

The merits of high grade Portland cements are so well known to consumers generally and particularly to manufacturers of concrete blocks that no dissension on this is needed.

The purchaser of true Portland cement is assured that he can depend upon such a product as being safe and reliable. Since, however, there is no general or positive law against the misbranding of inferior cements as Portland cements unprincipled manufacturers of inferior over clayed and natural cements, place these cements on the market as Portland cements and thereby deceive the purchaser into using these inferior cements in work for which it is not suitable, resulting in bad work.

The large contractors and consumers usually have rigid specifications and employ inspectors to make the necessary test. The small consumers not being supplied with testing arrangements have to depend on the honesty and reputation of the cement manufacturers. The name Portland Cement can only be applied to an artificial product manufactured from a calcareous and silicaous mixture burned to incipient fusion.

The writer has made frequent tests and analyses of Slag and Natural cements sold as Portland cement. A comparison of these results may again demonstrate the superiority of a true Portland cement.

Comparing the above results which represent average tests, the same explains itself. Both so-called Portland cements passed the severe test of a soundness which demonstrates again that the passing of Steam and Boiling tests are not sure indications of the quality of the cement. Cements hardening quickly, having a slow setting and obtain a high grade, and this test can only be obtained by a true Portland cement.

Therefore, beware of imitations; buy only the true Portland cement; there is a place for all of us in this world without using unfair business methods.

The Best is Always the Cheapest.

(Signed) George P. Dieckman,
Chemist.

Jackson, Mich., Feb. 28, 1907.

SPECIFIC HEAT OF FIRE BRICK.

By C. Fletcher Howe and Chas. B. Harrington.

Although the value of the specific heat of fire brick (especially at high temperatures) is necessary in many calculations, nothing had been done to determine it further than to estimate it roughly from the specific heats of the constituents of the brick until the authors took up the subject in 1904, continuing the work in 1906.

The brick (2½ in. x 2½ in. x 3 in.) is uniformly heated in a gas furnace to a high temperature, and then quickly transferred to a form of Bunsen's ice calorimeter of suitable shape and dimensions, designed for the purpose. The initial tempera-

tures, ranging from 500 degrees to 1100 degrees C., and subsequent temperatures are observed by means of a thermo-couple which extends through the bottom of the calorimeter into the center of the brick.

In each experiment the brick is allowed to remain in the calorimeter until a definite temperature at its center is reached (200 degrees C.), and then quickly removed. The heat given up by the brick in cooling from the initial temperature down to the fixed temperature, expressed in calories, when plotted against "initial temperatures," gives a parabola represented by the equation

$$H \text{ equal at plus } bt^2,$$

when H represents the heat in calories and the t the initial temperature. The values of the constants are found to be,

$$a \text{ equal } 117.7 \text{ and } b \text{ equal } .016.$$

The specific heat is the differential coefficient of H with respect to t, and the values calculated for each interval of 100 degrees are recorded below:

Temperature Range.	Specific Heat.
Degrees.	
1100—1000	.281
1000—900	.274
900—800	.268
800—700	.262
700—600	.257
600—500	.251
500—400	.245
400—300	.239
300—200	.233
200—100	.277
100—0	.221

While we confined our attention to one form of fire brick, it is probable that other forms of fire brick will not differ widely from the above in their specific heats.—The Journal of the Worcester Polytechnic Institute.

The German Postal and Telegraph Department has published statistics collected during a period of 52 years on the life of wooden posts impregnated with different preservative substances. The number of posts under observation amounted to nearly 3,000,000, and the following are the average results obtained:

	Length of Life.
Poles impregnated with Sulphate of Copper	11.7 years
Corrosive Sublimate	13.7 years
Cresote	20.6 years
Unimpregnated	7.7 years

The manner of preparing the poles has been improved from time to time, and this is clearly shown

CHEMICAL COMPOSITION

So-called Portland Cements.		True Portland Cement.	
		Slag Cement Per cent	Natural Cement Per cent
Acid Silica	SiO ₂	29.36	22.55
Alumina	Al ₂ O ₃	11.86	5.43
Oxide of Iron	Fe ₂ O ₃	3.00	3.12
Lime	CaO	50.06	51.55
Magnesia	MgO	2.90	11.40
Acid Sulphuric	SO ₃	1.16	2.92
Sulphur		2.21	3.00
Volatile			

PHYSICAL TESTS

Fineness . . . Per Cent	100 mesh	200-100 mesh		200 mesh	100 mesh	200 mesh
	96	82	91	77.5	94	76
	Initial Complete		Initial Complete		Initial Complete	
Setting time . .	2-30 hr	6-30 hr		2-20 hr	5 hrs	
Steam test . . .	Very slightly checked			O. K.		O. K.
Boiling test . .				O. K.		O. K.
Cold Water . . .	O. K. after 3 months			O. K.		O. K.

TENSILE STRENGTH

	Lbs.	Lbs.	Lbs.
24 hours	58-61-70 (neat)	185-160-115	280-270-278
1 day in air, 6 days in water	255-250-260	255-335-225	605-600-620
1 " " " 6 " " " "	(1:3)		
1 " " " 27 " " " "	115-130-125 (neat)	75-95-75	210-215-208
1 " " " 27 " " " "	(1:3)		
	295-360-370	300-340-290	690-689-700
	190-175-160	100-110-120	290-280-287

in a further table giving the average length of life of the poles under different methods of treatment with each preservative at different periods. For example, in 1883, with sulphate of copper the average life was 9.4 years, while in 1903 the method of treatment had been improved so that an average life of 13.3 years could be obtained.

J. Fletcher Williams of Detroit, vice president of the Egyptian Portland Cement Company of Fenton, Mich., in discussing the Michigan cement industry, has this to say:

"Whether the wet marl process or the lime rock process is used, if there is sufficient raw material, the plant has a good chance of success under proper management. This is shown by one of the wet process mills which paid 26 per cent dividend in 1906, and another, recently ranked as a "cripple," netted \$40,000 in six months.

"I saw an article in a Detroit paper stating that marl cement mills were on the road to ruin. This article must have been inspired by some one who is interested in rock cement, or who is lacking in information. While it is true that many wet process companies have met with disaster and been forced to reorganize, there is reason for this.

"The manufacture of Portland cement from marl in Michigan dates back but a few years, and little knowledge was available by the first mills on the subject of the wet process, so that each concern had to work out its own plans for manufacture, governed by local conditions. That is truly called the experimental period, and perfection has not been attained in either the wet or dry process even yet. This can be said of almost any industrial process.

"The difference of cost of manufacture between the dry and the wet method is still unsettled. Leading experts in the two methods are unable to agree, because success or failure in either depends so much on conditions at the site of manufacture.

"The machinery for a dry process mill is more than 20 per cent greater than for wet. The lime rock has to be quarried, conveyed to the mill and ground to a fine powder. Clay and sometimes free lime have to be added, since the rock does not always contain the required amount of carbonate of lime. These ingredients may have to be transported by rail to the mill.

"This is not necessary in the wet

process, since nature has provided the marl as used by a number of cement companies, in such fineness as to pass through a 100-mesh sieve, and with less than 1 per cent variation in the amounts of carbonate of lime. The marl is pumped into the mill from the lake bed at very low expense.

"The amount of fuel required to dry out the marl is pointed to as an obstacle; but it may be observed that fuel also is required for power to grind up the rock in the other process. The temperature of the gases thrown off by the boiler of a rock crushing plant is sufficient to dry marl.

"After the two products are secured in dry powder form, the processes are identical and the expense of manufacture the same.

"Failures in the marl process have been through lack of experience and neglect to make proper soundings of the deposits before installing expensive plants to depend on them.

"I believe the marl beds of Michigan are good for years to come."

EUROPEAN CEMENT FOR SEATTLE.

The receipt of 47,302 barrels of European Portland cement at Seattle on March 27 and 28 is the largest amount of cement ever received at that port in any two days. The cement came in three ships as follows: French bark *Eugenie Fautrel*, 160 days out from Rotterdam, with 16,812 barrels, closely followed by the British ship *Matterhorn*, 152 days out from Rotterdam, with 16,490 barrels. [The British ship *Riverside*, 163 days out from Rotterdam, completes the list with 14,000 barrels. There is some mystery about the place of origin of this cement. As it comes from Holland where there are no cement plants, it must come from Belgium, and in order to disguise the place of origin, it is shipped to Holland and from thence to Seattle, where the inferior Belgian cements are under the ban.]

Cement shipped from the U. S. to our insular possessions from July 1, 1906, to Feb. 28, 1907, amounted to 83,807 barrels valued at \$151,510, as follows: Alaska 2,895 barrels valued at \$9,094, Hawaii 3,390 barrels valued at \$7,094, Porto Rico 77,232 barrels valued at \$134,065, Phillipine Islands 290 barrels valued at \$580.

During the same period we shipped 61,553 barrels of cement to Panama valued at \$121,033.

CONCRETE MINE PROPS.

Atmospheric conditions in a coal mine make it necessary to renew the wood props and supports frequently, and the renewal is always a source of considerable expense. Props made from concrete, which are practically indestructible, are now being installed in coal and other mines successfully and economically.

THE MICHIGAN CEMENT INDUSTRY.

Eight Michigan plants use marl and 6 rock. One plant uses both marl and rock. 12 plants use Michigan clay, while 4 plants import their clay from other states. Every plant in the state expects to increase its output. The managers of all plants believe the demand for cement will show a continued increase.

Four hundred and forty-six skilled workmen are employed in the Michigan cement industry, receiving an average wage of \$2.82 per day, and 1,461 other employes receiving an average wage of \$2.41 per day. The total number of employees is 2,087 and the average daily wage \$2.49. The amount of money paid out annually in wages is \$1,397,600.

Guthrie, Ok.—Territorial charters were issued today as follows: The New York Concrete Stone Company of Guthrie and New York, with \$200,000 capital stock. The incorporators are G. V. Pattison, H. W. and L. E. Pentecost of Guthrie, Okla.

Frank Pyle of Osawatomie, Kan., has purchased 280 acres of land near Rantoul, Franklin Co., Kan., in the gas and oil belt. Mr. Pyle represents a syndicate which proposes to locate a cement plant on the land.

D. W. Mead, professor of hydraulic engineering at the Wisconsin State University, in an address before the Wisconsin Brick Makers' Association, said: "Concrete is bound to replace brick in tunnel and other heavy masonry work, due to the fact that bricklayers are always making trouble for contractors, as well as slight their work, and that from his own experience he found concrete workers were more skillful and willing to execute orders, whether they belonged to unions or not. Several members of the convention agreed with Prof. Mead's statement of labor conditions in the two classes of work.

**PUBLICATION OF THE UNIVERSITY
OF ILLINOIS ENGINEERING
STATION.**

The Engineering Experiment Station of the University of Illinois has recently issued Bulletin No. 9, "An Extension of the Dewey Decimal System of Classification Applied to the Engineering Industries." This bulletin is in effect a fifth edition of the extension previously issued by the Mechanical Engineering department. It contains the extensions previously worked out for mechanical and railway engineering, and in addition to a very complete extension for electrical engineering and more or less complete extensions for bridge engineering, sanitary engineering, metallurgy and architecture. An alphabetical index of subjects adds to the usefulness of the classifications.

The decimal system of classification devised by Mr. Melvil Dewey was intended primarily for the use of librarians in classifying and arranging books and pamphlets. It has, however, been used extensively by engineers, manufacturers and business concerns for indexing technical data of all kinds, catalogs, reports, drawings, etc. Bulletin No. 9 extends the work of Mr. Dewey to practically all fields of engineering industry, and presents a system of classification of great value to engineers and those engaged in engineering industries. Copies may be secured by application to the director of the Engineering Experiment Station, Urbana, Illinois.

Bulletin No. 10, Tests of Concrete and Reinforced Concrete Columns, Series of 1906, by Professor Arthur N. Talbot, has just been issued by the University of Illinois Engineering Experiment Station. This bulletin will be of interest to many engineers, architects and constructors engaged in reinforced concrete work. Comparatively few tests have been made on concrete columns and in most of these small test specimens were used. The tests described in this bulletin were made on the 600,000-pound testing machine in the Laboratory of Applied Mechanics. The care exercised in the testing, as well as the effort given to make the fabrication of the columns approach conditions of engineering construction, add to the value of the results. The study of the problem and the analysis of the tests made in the bulletin are features which will be appreciated by many readers. The results show the value of reinforcing columns with longitudinal rods and also the necessity of exercising care to secure uniformly good work

in construction. Attention is called to the fact that the strength of concrete columns may be expected to be less than that of cubes made and tested in the ordinary way. Caution is also given concerning the construction of columns in building operations. The bulletin uses a method of determining the relative stresses in steel and concrete and discusses the basis of working stresses and factor of safety for this kind of construction. Those interested in the analysis of the stresses which are developed in reinforced concrete will be interested in the views expressed as to whether elastic or inelastic deformations should be used in the determination of the modulus of elasticity and also in the form found for the stress-deformation curve of the concrete in the columns. The bulletin contains 64 pages. The work on concrete columns is being continued, a series of tests on hooped columns being now in progress.

Bulletin No. 12, Tests of Reinforced Concrete T-Beams, Series of 1905, has just been issued by the University of Illinois Engineering Experiment Station. This bulletin describes a preliminary series of tests on reinforced concrete T-beams undertaken to determine the effect of different widths of flange of beam which may be considered to contribute to the strength and stiffness of the beam, and also to find the effectiveness of the metallic web reinforcement used. The beams were reinforced with longitudinal rods having an area equivalent to 1 per cent of the rectangle inclosing the beam. All of the beams failed through tension in the longitudinal reinforcement, no failure being noticeable in the flanges. The web reinforcement proved effective, no failure occurring by diagonal tension in the stem of the T-beam. Fur-

ther experiments on T-beams are now in progress in the Laboratory of Applied Mechanics of the University of Illinois, which it is hoped will throw more light upon the strength of such beams.

**THE CORN PALACE CEMENT
WORKS CELEBRATING ITS
20TH ANNIVERSARY.**

P. P. Comoli, proprietor of the Corn Palace works, is receiving congratulations from friends on arriving at the twentieth year of business in Sioux City, Iowa. For a quarter of a century Mr. Comoli has been connected with the cement business. In the past two years Mr. Comoli has shown exceptional ability to designing and building residences of cement. These buildings are finished with simple tools, without the use of machinery, producing highly artistic work on strictly original lines. Mr. Comoli is the inventor of many of the tools used in his work.

His talk before the National Cement Users' Association Convention was a revelation on the possibilities of artistic concrete work.

We believe it would be a good business venture on the part of cement manufacturers to employ Mr. Comoli to give demonstrations in various parts of the country of his system of finishing cement work and thereby enlarge the scope of concrete work on artistic lines.

CEMENT PRODUCTION IN CANADA.

Canada produced 2,119,764 barrels of cement in 1906, while 700,000 barrels were imported, of which 689,380 barrels came from the United States, only 8,745 barrels were from Germany.

The grinding department of the Castalia Portland Cement Co. was destroyed by fire; loss \$50,000.

IMPORTS OF CEMENT INTO THE UNITED STATES.

WHERE FROM	FEBRUARY				EIGHT MONTHS ENDING FEBRUARY			
	1906		1907		1906		1907	
	Quantity in lbs.	Value in Dollars	Quantity in lbs.	Value in Dollars	Quantity in lbs.	Value in Dollars	Quantity in lbs.	Value in Dollars
United Kingdom . .		\$ —	24,450,600	\$ 79,745	6,870,786	\$ 21,976	193,098,864	\$ 621,754
Belgium	19,242,170	58,700	30,210,610	87,947	90,709,078	279,784	237,811,915	748,410
France	17,715	115	376,000	1,478	5,324,476	19,085	22,272,684	22,489
Germany	2,916,785	9,740	67,662,791	208,219	131,689,892	452,422	226,530,999	703,715
All Other Europe . .	306	1	—	—	—	1	20,629,070	61,744
British North Am. .	—	—	200	2	30,670	247	2,572,483	18,748
Other Countries . .	309	3	251,530	1,194	24,155	501	54,278,397	256,109
TOTAL	22,176,768	68,559	123,011,24	377,625	237,648,987	774,577	867,194,352	2,832,966
Domestic Exports of Cement, bbls. . . .	25,987	41,092	60,848	93,223	608,154	834,516	432,527	719,052

There were 5,873,659 lbs. of imported Roman and Portland Cement, etc., in the United States bonded warehouses in February, 1906, valued at \$17,502, against 19,879,528 lbs. in February, 1907, valued at \$57,500.

For eight months ending in February, 1906, there were 44,055 tons of asphaltum imported in the United States, valued at \$202,104, against 64,694 tons imported in eight months ending February, 1907, valued at \$266,430.

**CEMENT, MORTAR AND CONCRETE
—PREPARATION AND USE FOR
FARM PURPOSES.**

By Philip L. Wormeley, Jr.
U. S. Testing Engineer, Office of
Public Roads.

Cement.

The term "hydraulic cement" is applied to one of the most useful materials of engineering construction and one which in recent years has become widely extended in its field of application. Hydraulic cement possesses the property of hardening, or setting, under water, in which respect it differs from lime, which does not harden except in the presence of air. Thus it is evident that in all places where air is excluded, such foundations, thick walls, etc., cement mortar should be used instead of lime.

Only two classes of cement will be discussed here—Portland and natural. The difference between these is due partly to the method of manufacture and partly to the condition and relative proportions of the materials employed, which are, generally speaking, limestone and clay. In the manufacture of Portland cement the separate materials are mixed in such proportions as have been found by experience to give the best results. The mixing is done by grinding the materials together in mills, after which the mixture is burned at a very high temperature in kilns, and the resulting clinker ground to an impalpable powder is known as Portland cement. In the case of natural cement the materials used have been already mixed by nature in approximately the correct proportions, being found in the form of a rock, which is generally classed as a clay limestone, or a limey deposit technically called calcareous clay. This material is burned at a much lower temperature than Portland cement. When the manufacturer has each ingredient absolutely under control and can adjust the proportions to suit all conditions, it is reasonable to expect that a better and more uniform product will result than when the materials are found already mixed. Portland cement is far more extensively employed than natural cement on account of its superior strength, although the latter is frequently used in cases where great strength is of little importance. The superior strength and durability of cement as compared with lime, together with the low price at which it may now be procured, have caused the former to replace the latter in engineering construction to a great extent.

Storing Cement.—Cement must be kept dry during storage, when no house or shelter is available, a rough platform raised above the ground upon which the cement is placed and so covered to exclude water. Cement often improves with age. Cement is packed in bags and barrels and weighs as follows: 1 barrel of Portland cement weighs 380 pounds and contains $3\frac{1}{2}$ cubic feet. 1 bag of P. C. weighs 95 pounds and contains $\frac{1}{2}$ cubic foot. 1 barrel of Natural cement weighs 300 pounds (Western Natural Cement weighs 265 pounds). 1 bag Natural cement weighs 75 pounds, and contains $\frac{1}{2}$ of a cubic foot.

Cement Mortar.—Cement mortar is an intimate mixture of cement and sand diluted with sufficient water to produce a plastic mass. The amount of water will vary according to the proportion and condition of the sand, and had best be determined independently in each case. Sand is used both for the sake of economy and to avoid cracks due to shrinkage of cement in setting. Where great strength is required, there should be at least sufficient cement to fill the voids or air spaces in the sand and a slight excess is preferable in order to compensate for any uneven distribution in the mixing. Common proportions for Portland cement mortar are 3 parts sand to 1 of cement, and for natural cement mortar, 2 parts sand to 1 of cement. Unless otherwise stated, materials for mortar or concrete are considered to be proportioned by volume, the cement being lightly shaken in the measure used.

A "lean" mortar is one having only a small proportion of cement, while a "rich" mixture is one with a large proportion of cement. "Neat" cement is pure cement, or that with no admixture of sand. The term "aggregate" is used to designate the coarse materials entering into concrete—usually gravel or crushed rock. The proportion in which the three elements enter into the mixture is usually expressed by three figures separated by dashes—as, for instance, 1-3-5—meaning 1 part cement, 3 parts sand, and 5 parts aggregate.

In the great majority of cases cement mortar is subjected only to compression, and for this reason it would seem natural, in testing it, to determine its compressive strength. The tensile strength of cement mortar, however, is usually determined, and from this its resistance to compression may be assumed

to be from eight to twelve times greater. A direct determination of the compressive strength is a less simple operation, for which reason the tensile test is in most cases accepted as indicating the strength of the cement.

Mixing.—In mixing cement mortar it is best to use a platform of convenient size or a shallow box. First, deposit the requisite amount of sand in a uniform layer, and on top of this spread the cement. These should be mixed dry with shovels or hoes, until the whole mass exhibits a uniform color. Next, form a crater of the dry mixture, and into this pour nearly the entire quantity of water required for the batch. Work the dry material from the outside toward the center, until all the water is taken up, then turn rapidly with shovels, adding water at the same time by sprinkling until the desired consistency is attained. It is frequently specified that the mortar shall be turned a certain number of times, but a better practice for securing a uniform mixture is to watch the operation and judge by the eye when the mixing has been carried far enough. In brick masonry the mistake is frequently made of mixing the mortar very wet and relying upon the bricks to absorb the excess of water. It is better, however, to wet the bricks thoroughly and use a stiff mortar.

Grout.—The term "grout" is applied to mortar mixed with an excess of water, which gives it about the consistency of cream. This material is often used to fill the voids in stone masonry, and in brick work the inner portions of walls are frequently laid dry and grouted. The practice in either case is to be condemned, except where the conditions are unusual, as cement used in this way will never develop its full strength.

Lime and Cement Mortar.—L. C. Sabin finds that in a Portland cement mortar containing three parts sand to one of cement, 10 per cent of the cement may be replaced by lime in the form of paste without diminishing the strength of the mortar, and at the same time rendering it more plastic. In the case of natural cement mortar, lime may be added to the extent of 20 to 25 per cent of the cement with good results. The increased plasticity due to the addition of lime much facilitates the operation of laying bricks, and has caused lime and cement mortar to become largely used.

Cement Mortar for Plastering.—In plastering with cement, a few precautions must be observed to in-

sure good and permanent results. The surface to receive the plaster should be rough, perfectly clean, and well saturated with water. A mortar very rich in cement is rather a drawback than otherwise on account of shrinkage cracks, which frequently appear. The mortar, consisting of two or three parts sand to one of cement, should be mixed with as little water as possible and well worked to produce plasticity. It is essential that the plaster be kept moist until it has thoroughly hardened.

Materials for Making Concrete.—In securing sand for mixing mortar or concrete, if it is possible to select from several varieties, that sand should be chosen which is composed of sharp, angular grains, varying in size from coarse to fine. Such sand is, however, not always obtainable, nor is it essential for good work. Any coarse-grained sand which is fairly clean will answer the purpose. If gravel, sticks, or leaves be present they should be removed by screening. The voids in sand vary from 30 to 40 per cent, according to the variation in size of grains. A sand with different-sized grain is to be preferred, because less cement is required to fill the voids. By mixing coarse and fine sand it is possible to reduce the voids considerably.

It is customary to use the terms "river sand," "sea sand," or "pit sand," according to the source of supply. River sand as a rule has rounded grains, but unless it contains an excess of clay or other impurities, it is suitable for general purposes. When river sand is of a light color and fine-grained it answers well for plastering.

Sea sand may contain the salts found in the ocean. The tendency of these salts to attract moisture makes it advisable to wash sea sand before using it for plastering or other work which is to be kept perfectly dry.

Pit sand for the most part will be found to have sharp, angular grains, which make it excellent for mortar or concrete work. Where clay occurs in pockets it is necessary either to remove it, or else see that it is thoroughly mixed with sand. The presence of clay in excess frequently makes it necessary to wash pit sand before it is suitable for use.

The results of tests made in this laboratory would indicate that the presence of clay, even in considerable amounts, is a decided benefit to "lean" mortars, whereas it does not appreciably affect the strength of a rich mixture."

Gravel.—It is important that gravel for use in concrete should be clean, in order that the cement may properly adhere to it, and form a strong and compact mass. As with sand, it is well to have the pieces vary in size, thereby reducing the voids to be filled with mortar. The voids in general range from 35 to 40 per cent.

Crushed Stone.—The best stone for concrete work consists of angular pieces, varying in size and having a clean, rough surface. Some form strong and durable rock is to be preferred, such as limestone, trap, or granite. The total output of the crusher should be used be-

shape and variation in size of pieces, rarely falling below 40 per cent, unless much fine material is present, and in some cases reaching 50 per cent. A mixture of stone and gravel in equal parts makes an excellent aggregate for concrete.

Stone versus Gravel.—It would appear from tests that crushed stone makes a somewhat stronger concrete than gravel, but the latter is very extensively used with uniformly good results. This superiority of stone over gravel for concrete work is attributed to the fact that the angular pieces of stone interlock more thoroughly than do the rounded pebbles, and offer a rougher sur-

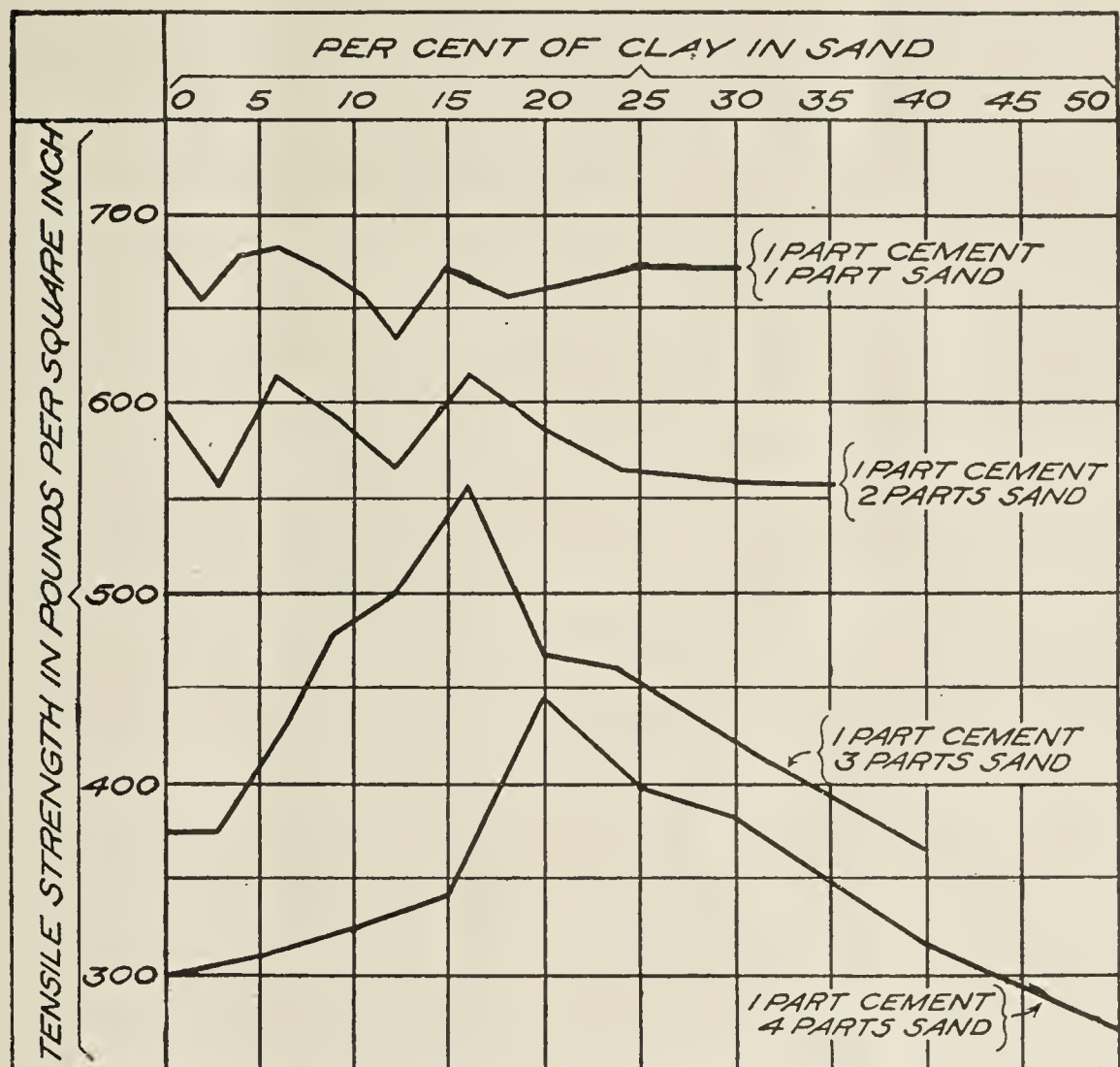


Diagram showing the effect of clay on cement mortars.

Fig. O.

low a maximum size, depending upon the nature of the work in hand. All material under one-eighth inch will act as so much sand and should be considered as such in proportioning the mixture. Precautions must be taken to insure a uniform distribution of the smaller pieces of stone, otherwise the concrete will have an excess of fine material in some parts and a deficiency in others.

Less than 8 per cent of clay will probably not seriously impair the strength of the concrete, provided the stones are not coated with it, and may even prove a benefit in the case of lean mixtures. The voids in crushed stone depend upon the

face to the cement. A point in favor of gravel concrete is that it requires less tamping to produce a compact mass than in the case of crushed stone. Then, too, the proportion of voids in stone being usually greater than in gravel, a proportionately greater amount of mortar is required to fill the voids, which means a slight increase in the cost of concrete.

Cinders.—Cinder concrete is frequently used in connection with expanded metal and other forms of reinforcement for floor construction, and for this purpose it is well adapted on account of its light weight. Its porosity makes it a poor conductor of heat and permits the driv-

ing of nails. Only hard and thoroughly burned cinders should be used, and the concrete must be mixed quite soft so as to require but little tamping and to avoid crushing the cinders. Cinder concrete is much weaker, both in tension and compression, than stone or gravel concrete, and for this reason admits only of light reinforcement.

Concrete.—Cement concrete is the product resulting from an intimate mixture of cement mortar with an aggregate of crushed stone, gravel, or similar material. The aggregate is crushed or screened to the proper size as determined from the character of the work. In foundation work, stone or gravel 3 inches in size may be used to advantage, whereas in the case of molded articles of small sectional area, such as fence posts, hollow building blocks, etc., it is best to use only such material as will pass a one-half inch screen. An ideal concrete from the standpoint of strength and economy, would be that in which all voids in the aggregate were completely filled with sand, and all voids in the sand completely filled with cement, without any excess. Under these conditions there would be a thoroughly compact mass and no waste of materials.

It is a simple matter to determine the voids in sand and also in the the proportions vary a great deal, depending in each case upon the nature of the work and the strength desired. For example, in the construction of beams and floor panels, where maximum strength with minimum weight is desired, a rich concrete is used, whereas in massive foundation work, in which bulk or weight is the controlling factor, economy would point to a lean mixture. When good stone or gravel is used, the strength of the concrete depends upon the strength of the mortar employed in the mixing and the proportion of mortar to aggregate. For a given mortar the concrete will be strongest when only enough mortar is used to fill the voids in the aggregate, less strength being obtained by using either a greater or less proportion. In practice it is usual to add a slight excess of mortar over that required to fill the voids in the aggregate.

It is more accurate to measure cement by weight, unless the unit employed be the barrel or sack, because when taken from the original package and measured in bulk there is a chance of error due to the amount of shaking the cement receives. As it is less convenient, however, to weigh the cement it is

more common to measure it by volume, but for the reason stated this should be done with care.

Proportioning Materials.—For an accurate determination of the best and most economical proportions where maximum strength is required, it is well to proceed in the following way: First, proportion the cement and sand so that the cement paste will be 10 per cent in excess of the voids in sand; next, determine the voids, with an excess of 10 per cent.

To determine roughly the voids in gravel or crushed stone, prepare a water-tight box of convenient size and fill with the material to be tested; shake well and smooth off even with the top. Into this pour water until it rises flush with the surface. The volume of water added, divided by the volume of the box, measured in the same units, represents the proportion of voids. The proportion of voids in sand may be more accurately determined by subtracting the weight of a cubic foot of packed sand from 165, the weight of a cubic foot of quartz, and dividing the difference by 165.*

For general use the following mixtures are recommended:

1 cement, 2 sand, 4 aggregate, for very strong and impervious work.

1 cement, 2½ sand, 5 aggregate, for ordinary work requiring moderate strength.

1 cement, 3 sand, 6 aggregate, for work where strength is of minor importance.

Aggregate Containing Fine Material.—In the case of gravel containing sand, or crushed stone from which the small particles have not been removed by screening, the amount of such sand or fine stone should be determined and due allowance made for it in proportioning the mortar.

When mixing an aggregate con-

*The following will serve as an example of proportioning materials: Assume voids in packed sand to measure 38 per cent and voids in packed stone to measure 48 per cent. Cement paste required per cubic foot of sand = $0.38 + \frac{1}{10} \times 0.38 = 0.42$ cubic foot, approximately. By trial 1 cubic foot of loose cement, lightly shaken, makes 0.85 cubic foot of cement paste, and requires $\frac{0.85}{0.42}$ or 2 cubic feet of sand, approximately, producing an amount of mortar equal to $0.85 + 2(1 - 0.38) = 2.09$ cubic feet. Mortar required per cubic foot of stone = $0.48 + \frac{1}{10} \times 0.48 = 0.528$ cubic foot. Therefore 2.09 cubic feet mortar will require $\frac{2.09}{0.528} = 4$ cubic feet of stone, approximately. The proportions are therefore 1 part cement, 2 parts sand, 4 parts stone. Although such a determination is usually considered unnecessary in practical work, it may be of sufficient interest to justify giving it.

taining small particles with mortar, the same conditions obtain as if these particles had been screened from the aggregate and added to the sand used in making the mortar, and in reality we have a mortar containing a larger proportion of sand than was present before the aggregate was incorporated. It is evident, then, that in such cases the quality or richness of the mortar should depend upon the proportion of fine material in the aggregate.

For example, suppose that 1 cubic foot of gravel contains 0.1 cubic foot of sand, and that the voids in gravel with the sand screened out measure 40 per cent. For general purposes this would suggest a 1-2-5 mixture, but since each cubic foot contains 0.1 cubic foot sand, 5 cubic feet of gravel will contain 0.5 cubic foot sand, and the proportions should be changed to 1 part cement, 1½ parts sand, 5 parts gravel.

Mechanical Mixers.—It has been demonstrated that concrete can be mixed by machinery as well, if not better, than by hand. Moreover, if large quantities of concrete are required, a mechanical mixer introduces marked economy in the cost of construction. None of the various forms of mechanical mixers will be described here, since concrete in small quantities, as would be used on the farm, is more economically mixed by hand.

Mixing by Hand.—In mixing concrete by hand a platform is constructed as near the work as is practicable, the sand and aggregate being dumped in piles at the side. If the work is to be continuous, this platform should be of sufficient size to accommodate two batches, so that one batch can be mixed as the other is being deposited. The cement must be kept under cover and well protected from moisture. A convenient way of measuring the materials is by means of bottomless boxes or frames made to hold the exact quantities needed for a batch.

A very common and satisfactory method of mixing concrete is as follows: First measure the sand and cement required for a batch and mix these into mortar as described on page 5. Spread out this mortar in a thin layer and on top of it spread the aggregate, which has been previously measured and well wetted. The mixing is done by turning with shovels three or more times, as may be found necessary to produce a thoroughly uniform mixture, water being added if necessary to give the proper consistency. The mixers, two or four in number, ac-

cording to the size of the batch, face each other and shovel to right and left, forming two piles, after which the material is turned back into a pile at the center. By giving the shovel a slight twist, the material is scattered in leaving it and the efficiency of the mixing is much increased.

Consistency of Concrete.—A dry mixture, from which water can be brought to the surface only by vigorous tamping, is probably the strongest, but for the sake of economy, and to insure a dense concrete well filling the molds, a moderately soft mixture is recommended for ordinary purposes. Where the pieces to be molded are thin, and where small reinforcing metal rods are placed close together, or near the surface, a rather wet mixture may be necessary to insure the molds being well filled.

Use of Quick-Setting Cement.—In the manufacture of such articles as pipe, fence posts, and hollow blocks, a rather large proportion of quick-setting cement is sometimes used; the object being to reduce the weight and consequent freight charges by means of a strong mixture, as well as to make the concrete impervious to water. The use of a quick setting cement permits the molds to be removed sooner than would be possible with slow-setting cement, thus reducing the number of molds necessary for a given output. Quick-setting cements are not recommended for such purposes, however, as they are usually inferior to those which set slowly.

Coloring Cement Work.—In coloring cement work the best results are obtained by the use of mineral pigments. The coloring matter, in proportions depending upon the desired shade, should be thoroughly mixed with the dry cement before making the mortar. By preparing small specimens of the mortar and noting the color after drying, the proportions may be determined:

For gray or black, use lampblack.

For yellow or buff, use yellow ochre.

For brown, use umber.

For red, use venetian red.

For blue, use ultramarine.

Depositing Concrete.—Concrete should be deposited in layers of from 4 to 8 inches and thoroughly tamped before it begins to harden. The tamping required will depend upon the consistency of the mixture. If mixed very dry it must be vigorously rammed to produce a dense mass, but as the proportion of water increases less tamping will be found necessary. Concrete should not be

dumped in place from a height of more than 4 feet, unless it is again mixed at the bottom. A wooden incline may be used for greater heights. Rammers for ordinary concrete work should weigh from 20 to 30 pounds and have a face not exceeding 6 inches square. A smaller face than this is often desirable, but a larger one will be less effective in consolidating the mass. In cramped situations special forms must be employed to suit the particular conditions. When a thickness of more than one layer is required, as in foundation work, two or more layers may be worked at the same time, each layer slightly in advance of the one next above it and all being allowed to set together. At the end of a day there is usually left a layer partially completed which must be finished the next day. This layer should be beveled off, but the last batch of concrete should be tamped behind a vertical board forming a step.

To avoid introducing a plane of weakness where fresh concrete is deposited upon that which has already set, certain precautions have to be observed. The surface of the old work should be clean and wet before fresh material is put on, a thin coating of neat cement grout being sometimes employed to insure a good bond. The surface of concrete to receive an additional layer must not be finished off smoothly, but should offer a rough surface to bond with the next layer. This may be done by roughing the surface while soft with pick or shovel, or the concrete may be so rammed as to present a rough and uneven surface. Wooden blocks or scantling are sometimes embedded several inches in the work and removed the concrete hardens, thus forming holes or grooves to be filled by the next layer.

Retempering.—As stated before, it is important that concrete be tamped in place before it begins to harden, and for this reason it is proper to mix only so much at a time as is required for immediate use. The rettempering of concrete has begun to set is a point over which there is much controversy. From tests made in this laboratory it would appear that such concrete suffers but little loss of strength if thoroughly mixed with sufficient water to restore normal consistency.

The time required for concrete to set depends upon the character of the cement, upon the amount and temperature of the water used in mixing, and upon the temperature of the air. Concrete mixed dry sets

more quickly than if mixed wet, and the time required for setting decreases as the temperature of the water rises. Warm air also hastens the setting.

Concrete Work In Freezing Weather.—Although it is advisable under ordinary circumstances to discontinue cement work in freezing weather, Portland cement may be used without serious difficulty by taking a few simple precautions. As little water as possible should be used in mixing, to hasten the setting of the cement. To prevent freezing, hot water is frequently used in mixing mortar or concrete, and with the same object in view salt is added in amounts depending upon the degree of cold. A common practice is to add 1 pound of salt to 18 gallons of water, with the addition of 1 ounce of salt for each degree below 32 degrees F. Either of the above methods will give good results, but it should be remembered that the addition of salt often produces efflorescence. It seems to be a fairly well-established fact that concrete deposited in freezing weather will ultimately develop full strength, showing no injury due to the low temperature.

Rubble Concrete.—In massive concrete work considerable economy may often be introduced by the use of large stones in the body of the work, but only in heavy foundations, retaining walls, and similar structures should this form of construction be permitted. In placing these large stones in the work the greatest care must be exercised to insure each being well bedded, and the concrete must be thoroughly tamped around them. Each stone should be at least 4 inches from its neighbor and an equal distance from the face of the work.

To Face Concrete.—A coating of mortar one-half to 1 inch in thickness is frequently placed next the form to prevent the stone or gravel from showing and to give a smooth and impervious surface. If in preparing this mortar finely crushed

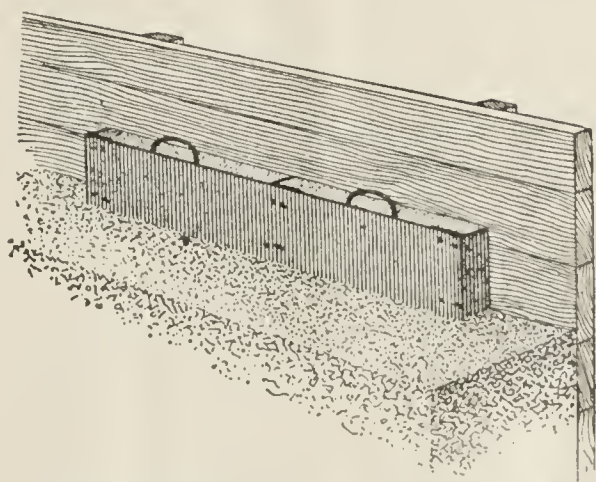


Fig. 1—Sheet metal plate used in facing concrete.

stone is used instead of sand, the work will more nearly resemble natural stone. A common method employed in facing concrete is to provide a piece of thin sheet metal of convenient length and about 8 or 10 inches wide. To this pieces of angle iron are riveted, so that when placed next to the mold a narrow space is formed in which the cement mortar is placed after the concrete has been deposited behind it (fig. 1). The metal plate is then withdrawn and the concrete well tamped. The concrete and facing mortar must be put in at the same time so that they will set together. If the concrete is fairly rich, a smooth surface can usually be produced without a facing of mortar by working a spade up and down between the concrete and inner face of the mold, thus forcing the larger pieces of the aggregate back from the surface.

Wood for Forms.—Lumber used in making forms for concrete should be dressed on one side and both edges. The expansion and distortion of the wood due to the absorption of water from the concrete frequently make it difficult to produce an even surface on the work, and unless the forms are accurately fitted together more or less water will find its way out through the cracks, carrying some of the cement with it. A method sometimes adopted to minimize the effect of expansion is to bevel one edge of each board, allowing this edge to crush against the square edge of the adjacent board when expansion takes place. In the case of a wooden core or inside mold, expansion must always be taken into consideration, for if neglected it may cause cracks or complete rupture of the concrete. Sharp edges in concrete are easily chipped and should be avoided by placing triangular strips in the corners of molds. To prevent cement from sticking to the forms they may be given a coating of soft soap or be lined with paper. This greatly facilitates their removal and enables them to be used again with but little scraping. A wire brush answers best for cleaning the forms.

Concrete Sidewalks.—A useful and comparatively simple application of concrete is in the construction of sidewalks, for which purpose it has been used with marked success for a number of years.

Excavation and Preparation of Subgrade.—The ground is excavated to subgrade and well consolidated by ramming to prepare it for the subfoundation of stone, gravel, or cinders. The depth of excavation

will depend upon the climate and nature of the ground, being deeper in localities where heavy frosts occur or where the ground is soft than in climates where there are no frosts. In the former case the excavation should be carried to a depth of 12 inches, whereas in the latter from 4 to 6 inches will be sufficient. No roots of trees should be left above subgrade.

The Subfoundation.—The subfoundation consists of a layer of loose material, such as broken stone, gravel, or cinders, spread over the subgrade and well tamped to secure a firm base for the main foundation of concrete which is placed on top. It is most important that the subfoundation be well drained to prevent the accumulation of water, which, upon freezing, would lift and crack the walk. For this purpose it is well to provide drain

The Top Dressing or Wearing Surface.—To give a neat appearance to the finished walk, a top dressing of cement mortar is spread over the concrete, well worked in, and brought to a perfectly smooth surface with straightedge and float. This mortar should be mixed in the proportion 1 part cement to 2 parts sand, sharp coarse sand or screenings below one-fourth inch of some hard, tough rock being used. The practice of making the concrete of natural cement and the wearing surface of Portland is not to be commended, owing to a tendency for the two to separate.

Details of Construction.—A cord stretched between stakes will serve as a guide in excavating, after which the bottom of the trench is well consolidated by ramming, any loose material below subgrade being replaced by sand or gravel. The

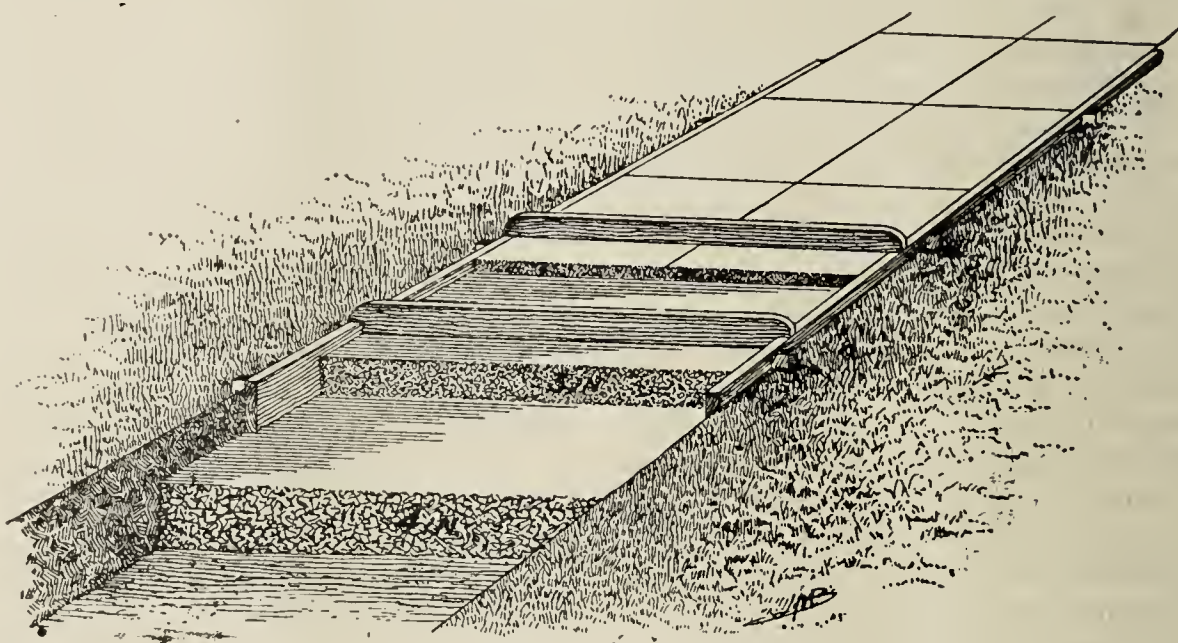


Fig. 2.—Forms for constructing concrete walk.

tile at suitable points to carry off any water which may collect under the concrete. An average thickness for subfoundation is 4 to 6 inches, although in warm climates, if the ground is firm and well drained, the subfoundation may be only 2 to 3 inches thick or omitted altogether.

The Foundation.—The foundation consists of a layer of concrete deposited on the subfoundation and carrying a surface layer or wearing coat of cement mortar. If the ground is firm and the subfoundation well rammed in place and properly drained, great strength will not be required of the concrete, which may, in such cases, be mixed in about the proportions 1-3-6, and a depth of only 3 to 4 inches will be required. Portland cement should be used and stone or gravel under 1 inch in size, the concrete being mixed of medium consistency, so that moisture will show on the surface without excessive tamping.

material to form subgrade is then spread over the bottom of the trench to the desired thickness and thoroughly compacted. Next, stakes are driven along the sides of the walk, spaced 4 to 6 feet apart, and their tops made even with the finished surface of the walk, which should have a transverse slope of one-fourth inch to the foot for drainage. Wooden strips at least 1½ inches thick and of suitable depth are nailed to these stakes to serve as a mold for the concrete. By carefully adjusting these strips to the exact height of the stakes they may be used as guides for the straightedge in leveling off the concrete and wearing surface. The subfoundation is well sprinkled to receive the concrete, which is deposited in the usual manner, well tamped behind a board set vertically across the trench, and leveled off with a straightedge as shown in fig. 2, leaving one-half to 1 inch for the wear-

ing surface. Three-eighths inch sand joints are provided at intervals of 6 to 8 feet to prevent expansion cracks, or, in case of settlement, to confine the cracks to these joints. This is done either by depositing the concrete in sections, or by dividing it into such sections with a spade when soft and filling the joints with sand. The location of each joint is marked on the wooden frame for future reference.

Care must be exercised to prevent sand or any other material from being dropped on the concrete, and thus preventing a proper union with the wearing surface. No section should be left partially completed to be finished with the next batch or left until the following day. Any concrete left after the completion of a section should be mixed with the next batch.

It is of the utmost importance to follow up closely the concrete work with the top dressing in order that the two may set together. This top dressing should be worked well over the concrete with a trowel, and leveled with a straightedge (fig. 2) to secure an even surface. Upon the thoroughness of this operation often depends the success or failure of the walk, since a good bond between the wearing surface and concrete base is absolutely essential. The mortar should be mixed rather stiff. As soon as the film of water begins to leave the surface, a wooden float is used, followed up by a plasterer's trowel, the operation being similar to that of plastering a wall. The floating, though necessary to give a smooth surface, will, if continued too long, bring a thin layer of neat cement to the surface and probably cause the walk to crack.

The surface is now divided into sections by cutting entirely through, exactly over the joints in the concrete. This done with a trowel guided by a straightedge, after which the edges are rounded off with a special tool called a jointer, having a thin shallow tongue (fig. 3). These sections may be subdivided in any manner desired for the sake of appearance.

A special tool called an edger (fig. 4) is run around the outside of the walk next to the mold, giving it a neat rounded edge. A toothed roller (fig. 5) having small projections on its face is frequently used

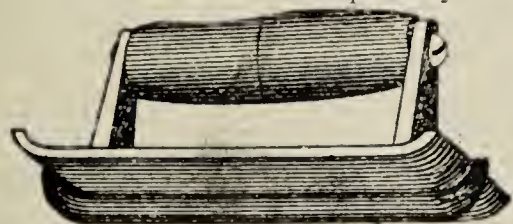


Fig. 3.—Jointer for dividing walk into sections.

to produce slight indentations on the surface, adding somewhat to the appearance of the walk. The completed work must be protected from the sun and kept moist by sprinkling for several days. In freezing weather the same precautions should be taken as in other classes of concrete work.

Concrete Basement Floors.—Basement floors in dwelling houses as a rule require only a moderate degree of strength, although in cases of very wet basements, where water pressure from beneath has to be resisted, greater strength is required than would otherwise be necessary.

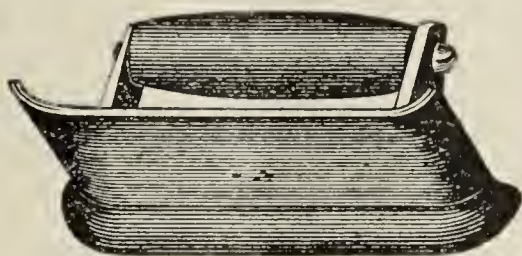


Fig. 4.—Tool for rounding edge of work.

The subfoundation should be well drained, sometimes requiring the use of tile for carrying off the water. The rules given for constructing concrete sidewalks apply equally well to basement floors. The thickness of the concrete foundation is usually from 3 to 5 inches, according to strength desired, and for average work a 1-3-6 mixture is sufficiently rich. Expansion joints are frequently omitted, since the temperature variation is less than in outside work, but since this omission not infrequently gives rise to unsightly cracks, their use is recommended in all cases. It will usually be sufficient to divide a room of moderate size into four equal sections, separated by one-half inch sand joints. The floor should be given a slight slope toward the center or one corner, with provision at the lowest point for carrying off any water that may accumulate.

Concrete Stable Floors and Driveways.—Concrete stable floors and driveways are constructed in the same general way as basement floors and sidewalks, but with a thicker foundation, on account of the greater strength required. The foundation may well be 6 inches thick, with a 1-inch wearing surface. An objection sometimes raised against concrete driveways is that they become slippery when wet; but this fault is in a great measure overcome by dividing the wearing surface into small squares about 4 inches on the side, by means of triangular grooves three-eighths of an inch deep. This gives a very neat appearance and furnishes a good foothold for horses.

Concrete Steps.—Concrete may be advantageously used in the construction of steps, particularly in damp places, such as areaways and cellars of houses; and in the open, where the ground is terraced, concrete steps and walks can be made exceedingly attractive. Where the ground is firm it may be cut away as nearly as possible in the form of steps, with each step left 2 or 3 inches below its finished level. The steps are formed, beginning at the top, by depositing the concrete behind vertical boards so placed as to give the necessary thickness to the risers and projecting high enough to serve as a guide in leveling off the tread. Such steps may be reinforced where greater strength is desired or where there is danger of cracking, due to settlement of the ground.

Where the nature of the ground will not admit of its being cut away in the form of steps, the risers are molded between two vertical forms. The front one may be a smooth board, but the other should be a piece of thin sheet metal, which is more easily removed after the earth has been tamped in behind it. A simple method of reinforcing steps is to place a half-inch steel rod in each corner, and thread these with quarter-inch rods bent to the shape of the steps, as shown in fig. 6, the latter being placed about 2 feet apart. For this class of work a rich

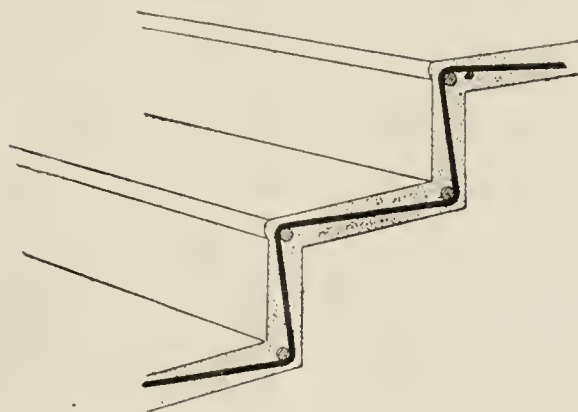


Fig. 5.—Reinforced Concrete steps.

Portland cement concrete is recommended, with the use of stone or gravel under one-half inch in size. Steps may be given a half-inch wearing surface of cement mortar mixed in the proportion 1 part cement to 2 parts sand. This system, as well as many others, is well adapted for stairways in houses.

Harold Jones, one of the chemists at the Indian Portland cement plant at Neodesha, Kansas, was badly hurt in an automobile accident. Mr. Jones was formerly connected with the laboratory of the Quincy plant of the Wolverine Portland Cement Co.

**MODERN STEAM ENGINEERING
THEORY AND PRACTICE.**

By Gardier D. Hiscox, M. E.

487 Pages—6x9 in. 405.

Engravings and diagrams, price \$3.00. The Norman W. Henley Publishing Co., N. Y.

This is a complete and practical up to date work issued for Stationary Engineers and Firemen dealing with the care and management of Boilers, Engines, Pumps, Superheated Steam, Refrigerating Machinery, Dynamos, Motors, Elevators, Air Compressors, and all other branches with which the modern Engineer must be familiar. It fully describes and illustrates the properties and use of Steam for the generation of power in the various types of engines in use. The Slide Valve, High-Speed, Corliss, Compound, Multi-expansion engines and their valve gear, the De Laval, Parsons, Curtiss and other Turbines are included and fully described and illustrated. Forty-two tables of the properties and application of steam in its various uses are included which in themselves form a most valuable and instructive section of the work.

The book has been specially prepared for the use of modern Steam Engineer, the Student, and for the daily use of those who have to run and maintain power plants of all kinds. It gives only the latest and most reliable information.

Nearly two hundred questions with their answers on Steam and Electrical Engineering, likely to be asked by the Examining Board are included. This book is thoroughly reliable and practical, and not only a guide but a teacher. As a text book it is the latest and best authority on the subject. It is fully illustrated with detail engravings, not to be found elsewhere.

The U. S. Portland Cement Co. is about ready to commence work on a 1,400-barrel plant one mile below Portland, Colorado. One hundred and fifty foot rotary kilns will be used.

The U. S. Concrete Ry. Crossite Co. of St. Louis, propose to erect a cement plant at Chamberlain, S. Dak., provided they receive a \$600,000 bonus in return. The company agree to erect a plant to manufacture 2,000 barrels of cement per day. The company to raise an extra \$100,000 and to employ 350 men who are to receive \$800 per day.

Archie Hush, an employee of the Indian Portland Cement Company at Neodesha, was working the lever on a clutch which starts the tube mills. The lever flew out of his hands, striking his chin, which was crushed in, cutting off the end of his tongue.

Two blind men, Joseph Brown and Joseph Martinez, of Berkeley, California, did all the carpenter work on a house 25x18 and one and one-half stories high. The work is said to be as good as that done by ordinary builders.

Mr. B. H. Rader has been appointed Eastern sales agent of the Universal Portland Cement Co., with offices in the Frick Building, Pittsburg.

INCORPORATED.

The Mobile Cement Co., of Mobile, Ala., capital \$3,000, to do general concrete construction work.

There is a car famine in Michigan and other states. One cement company ordering 50 cars received only two cars in two weeks.

Chas. A. Matcham and other Lehigh county capitalists have incorporated a Portland cement company to construct a plant in West Virginia. Capital, \$3,500,000. The head office will be in the Allentown National Bank building at Allentown, Pa.

The town of Ilasco, mainly inhabited by the employes of the Atlas Portland Cement Co., is to be abandoned on account of the Ralls county, Mo., court granting dram shop licenses to saloons in the town. A new town is to be built in Pike county one mile north of Ilasco on the Atlas company's own land as an inducement for its employees to move to the new town, and thus starve out the saloons, whose influence on its employees it fears.

The Missouri Portland Cement Co. of Oklahoma City, Okla., has been incorporated. Capital stock, \$1,500,000. The directors are J. Blenkendorf and H. W. McNutt of St. Joseph, Mo.; S. T. Bisbee of Oklahoma City.

The Union Portland Cement company of Rushsylvania, Ohio, \$400,000—half being 6 per cent. preferred—Dwight Harrison, William T. McClure, H. Ganong, A.

T. Schryver and Emma Badger. The incorporators are Columbus, Ohio, men.

The Spokane Portland Cement Co., of Spokane, Wash., incorporated by N. M. Kuppenberg, D. H. Butz, Geo. Walker O. M. Shock and C. S. Bachenbock of Spokane, Wash.

The U. S. Portland Cement of Yocemento, Ellis Co., Kan., has been chartered. Capital, \$900,000. The incorporators are I. M. Yost, Henry Schwaller and J. H. Ward all of Hays City, Kans.; Ira E. Lloyd, Elsworth, Kan.; E. Haworth, Lawrence, Kan.

A Portland Cement plant is to be erected at El Paso, Tex. Capital \$1,100,000 preferred 8 per cent stock. Carl Leonard, Los Angeles, Pres.; Chas. Boulcher, Treasurer. Denver, Co.; A. Courchesne, Vice Pres.; J. F. Williams, Secy. The buildings will be cement and steel. The directors of the company are as follows: C. Leonard of Los Angeles, Charles Boulcher and Whitney Newton of Denver, Aman Moore of Ogden, Utah; O. J. Binford of Los Angeles, Sullivan Luna and M. Flournoy of Albuquerque, A. Courchesne, Felix Martinez, J. F. Williams and H. B. Stevens of El Paso. The plant is to have a capacity of 1,400 barrels per day, 900 acres of land, carrying lime stone and shale have been purchased.

THREE FORKS PORTLAND CEMENT CO.

Articles of incorporation have been filed by the Three Forks Portland Cement company with a capitalization of \$2,400,000 of the par value of \$100 each. Eight thousand of the shares are preferred, paying 7 per cent, and 16,000 shares are common stock. The incorporators and directors of the company are James Pingree, Joseph Scowcroft, C. Browning, M. Boetscher, Aman Moore, J. Gilson and Hiram Pingree of Ogden, Utah; William Newton of Denver; J. D. Slemmons and F. T. McBride of Butte. The company owns 3,000 acres of cement deposits five miles west of Logan, Gallatin, S. Montana, in this state and proposes to expend \$600,000 in the erection of a plant with a capacity of producing 1,500 barrels of cement a day.

A LARGE ORDER FOR SAND.

The Garden City Sand Co., of Chicago has secured a contract for the delivery of over 125,000 cubic yards of gravel to be used in the New Montgomery Ward & Co. new warehouse and office building at Chicago avenue and the river. The structure will be 8 stories high, constructed throughout in reinforced concrete, with a floor space of more than 1,000,000 square feet, making the structure the largest of the kind in the United States.

Chicago Cement Stone Machinery company, Chicago, Ill.; \$10,000; manufacturing concrete machinery; Fred W. Dunn, Herman Haussmann, Charles F. Glaeser.

HAYS CITY, KANSAS.

Work has been begun on the new 1,000 bbl. Cement Plant for the Uncle Sam Portland Cement Company, at Yocemento, between this city and Ellis, on the Union Pacific Railroad.

The Freeborn Engineering and Construction Company of Kansas City, Mo., are engineers and also have the contract for the construction.

The Saginaw Concrete Stone Co., of Saginaw, Mich., has been organized to manufacture hollow concrete blocks, ornamental work, columns and steps. The following named parties are interested in the enterprise: Lloyd M. Richardson, Robert K. Richardson and Ard E. Richardson.

Badger Portland Cement Co., of Appleton and Sturgeon Bay, Wis., has been organized to erect a plant north of Sturgeon Bay, Wis., where several hundred acres of land have been purchased. The company is being financed by many of the leading paper mill and paper pulp manufacturers in the state. The officers are as follows: John McNaughton, President, of Appleton; L. C. Locklin, Vice President, Green Bay; C. G. Cannon, Treasurer, Appleton; Chellis C. Wayland, of Portage. Directors: John Barnes, of Madison; A. W. Shelton Rhinelander, J. H. Delbridge, W. H. Williams, of Madison. All of Wisconsin.

The plant is to have a capacity of 2,000 barrels per day and will be located on the water front, where fuel can be loaded directly into the plant which will be operated by producer gas.

The United Cement Machinery Co., of Columbus, Ohio, has taken over The Frost Cement Block Machine Co., of Waterloo, Iowa, and will likewise handle the Waterloo Cement Machinery Co. product as well as that of the Leusch Manufacturing Company.

A complete line of machinery will be carried in stock at Waterloo in charge of J. L. Shannon.

The large independent gypsum plants of the country are to unite into a single company in opposition to the U. S. Gypsum Company. The following companies will be included in the consolidation: The Acme Company of St. Louis, American Gypsum Company of Port Clinton, O.; Niagara Gypsum Company of Buffalo and one other large western concern.

THE KOSMOS PORTLAND CEMENT CO.

The Portland cement industry in Kentucky has within the last two years been augmented by the organization of the Kosmos Portland Cement Company, and the completion of its 1,200 barrel plant at Kosmosdale, Ky., 18 miles south of Louisville, upon the banks of the Ohio river.

The raw material is in a ledge 300 feet high, $1\frac{1}{4}$ mile long, and $\frac{3}{4}$ mile deep at this location, convenient to the river. Mr. Samuel Horner, Jr., of Philadelphia, realized the opportunities offered, and in June, 1904, work was begun upon the plant and town of Kosmosdale. In the fall of 1905, the manufacture of Kosmos Portland cement was begun. The success of the enterprise is attested by the fact that of the entire output of the plant since starting, not one barrel of cement has ever been rejected. To meet the large demand for this cement, contracts have recently been let to the Freeborn Engineering & Construction Company of Kansas City, Mo., for enlarging the plant to 3,000 barrels capacity.

The officers of the Kosmos Portland Cement Company are Samuel Horner, Jr., Pres.; Robert Horner, Vice-Pres. and Treas., and A. McCracken, Sec'y. Sales offices are in the Todd Building, Louisville, Ky. and general offices and works at Kosmosdale, Ky.

The Watertown Cement Construction Company of Watertown,

S. Dakota, has been formed by C. H. Englesby, the adjutant general of S. Dakota and S. G. Eggleston, to do general concrete construction business.

J. G. Stroud of Williston, N. Dakota, has purchased a complete outfit of the National Hydraulic Stone Co., Fisher system, and will operate the same at Williston on a large scale.

Cleveland, Ohio, April 10.—Elizabeth C. Hackenburg asked Common Pleas Court today to appoint a receiver for the Iroquois Portland Cement Company, a \$500,000 corporation.

She also asked for an injunction to prevent the refinancing of the corporation in which she owns fifty shares. The offices of the company are in Cleveland, O.

A. W. Barker of Pierre, S. D., manufacturer of cement brick, has contracts for the new court house and city hall, a creamery building, a hospital, the News building, stock growers' building, the Fairplay building, a school house and several other all of cement brick. This is only a beginning in cement construction at Pierre.

Wichita, Kansas, is to have a seven story reinforced concrete building.

The Century Cement Machine Company of Rochester, N. Y., report sales of the Hercules Concrete Block Machine to the city of New York, and two sales to contractors in India and China. Mr. A. T. Bradley of the company, is strongly advocating a coarse mixture for backing, and finds that his judgment is backed by the experience of contractors who do large work.

The Metropolitan Life Insurance building to be erected at Madison Avenue and 24th street, New York, will be 46 stories high including the tower or 658 feet above the sidewalk. The floor area of the entire building will be equal to 25 acres. There will be two stories below the sidewalk. From the lower floor of the sub-basement to the top of the tower will be 690½ feet.

THE AETNA PORTLAND CEMENT CO. LITIGATION.

Lawton Becker of Fenton, Mich., has been appointed receiver of the Aetna Portland Cement Co. by the Genessee County Circuit Court, Judge Wisner presiding. The appointment was made several weeks ago but on account of an appeal taken by the majority bondholders. This appeal was dismissed by the upper court, and the receiver at once took charge of the plant without further protest.

The Aetna plant was making about \$500 a day when the officers of the company defaulted the interest on the mortgage. The result was that the bonds depreciated in value. R. D. Evans of Boston, president; John A. Myers of Detroit, secretary and treasurer, and Bernard Stroh of Detroit, vice-president, then proceeded to buy up the majority of the bonds, some of them at about 50 cents on the dollar.

The Metropolitan Trust Co. of New York was the trustee, was ousted and Reme E. Paine, a nephew of President Evans, was appointed trustee in its place.

The purchasers of the majority of the bonds then started foreclosure proceedings against the Aetna company. The directors, being the purchasers of the majority of the bonds, did not oppose the foreclosure.

At that point of the proceedings the minority bondholders, holding about \$80,000 of the bond issue of \$400,000, retained attorneys to defend their interests, and asked for a receiver, setting up the above charges.

The affirming of the appointment of the receiver and the findings as above by Judge Wisner is an out and out victory for the minority bondholders. The amount of interest on which the company defaulted was only \$12,000. The attorneys charged Evans, Myers and Stroh with attempting to close out the minority bondholders. The Aetna was formerly the Detroit Portland Cement Co.

The Maryland Portland Cement Co. of Hagerstown, Md., will erect a large Portland cement plant on a tract of land coneying lime stone. The shale will be brought from Williamsport south of Hagerstown. The ground is being surveyed for the location of the buildings. A 1,000 barrel unit will be completed with provisions for extension up to 2,500 barrels per day. Fred H. Lewis of Leeds, Ala., prepared the

plans and will superintend the erection of the plant, assisted by Arnold Hochstasser of New York.

ALIENS AND MINERAL LANDS IN THE STATE OF WASHINGTON.

The constitution of the state of Washington permits aliens to acquire title to mineral lands only, the State Supreme Court limited the term mineral lands to lands bearing precious metals only, excluding all other minerals. Several years ago a syndicate of English, German and Belgian capitalists became interested in lands carrying lime stone, shale and clay, the title being in name of Ernest E. Evans, an alien. Plans were prepared for a large Portland cement plant to be erected in Whatcom county, Washington, on May 5th, 1906. The state commenced suit against Ernest E. Evans to declare his lands forfeited to the state, which arrested the cement plant project, the lower courts found for the state. An appeal was taken to the State Supreme court which reversed the finding of the lower court as well as its own previous decision holding that aliens could lawfully hold title to any kind of mineral lands, thus confirming title of Evans to the lands in question. The European syndicate now has a free hand to develop its cement project.

David M. Bye of Bay City, Mich., is reported to have perfected a process for blowing cement into moulds for manufacture of jars and bottles.

PEBBLE DUST AND CEMENT FINISH.

Plastering buildings on the outside with pebble dash or cement is sometimes known as stucco work. It may be used for veneering new buildings or for covering old structures. It is quite desirable and seems to be a very satisfactory method. As a rule two coats are used, the first a scratch coat composed of five parts Portland cement, 12 parts clean, coarse sand, 3 parts lime, and a small quantity of hair. The second or finishing coat is composed of 1 part of Portland cement, 3 parts of clean coarse sand, and 1 part of slaked lime paste. Should only one coat be desired, the finishing coat is used. Some masons prefer mortar in which no lime is used, but this requires more time to apply.

In applying stucco to brick or stone structures, clean the surface of the wall, wet thoroughly, and plaster one and one-half inches thick. For a finish, either smooth with a

wooden float or rough by rubbing with burlap. In using stucco on a frame structure, first cover with two thicknesses of roofing paper. Next put on furring strips about one foot apart, and on these fasten wire lathing. Apply the scratch coat one and one-half inches thick and press it partly through the openings in the lath, roughing the surface with a stick or trowel. Allow this to set well and apply the finishing coat one-half to one inch thick. This coat can be put on and smoothed with a wooden trowel or a large stiff fiber brush if a spattered dash finish is desired. A pebble dash finish may be obtained by using 1 part of Portland cement, 3 parts coarse sand and pebbles not over one-fourth inch in diameter; throw on with a trowel.

The Phelps Publishing Co. of Springfield, Mass., will erect a large reinforced concrete office and manufacturing building fronting 285 feet on Washington St. Covering the entire block between Water street and Broadway. It will have a floor area of 225,000 square feet, equal to 5 acres and eight stories or about 100 feet high above the sidewalk. F. S. Hinds architect and engineer of 19 Milk street, Boston, has the plans underway. Contracts will be let in the near future.

Editor Cement and Engineering News:

Will you please give the name and address of the secretary of the National Cement Users' Association? J. Smith, N. Y. City.

Write to Richould & Humphrey, Harrison Bldg., Philadelphia, Pa. We do not know who is secretary of the association at this time.—Ed.

Calgary, Alta., April 17.—The Alberta Portland Cement company closed down its works this afternoon on account of the lack of coal and the strike at Coal Creek. This throws 114 men out of employment.

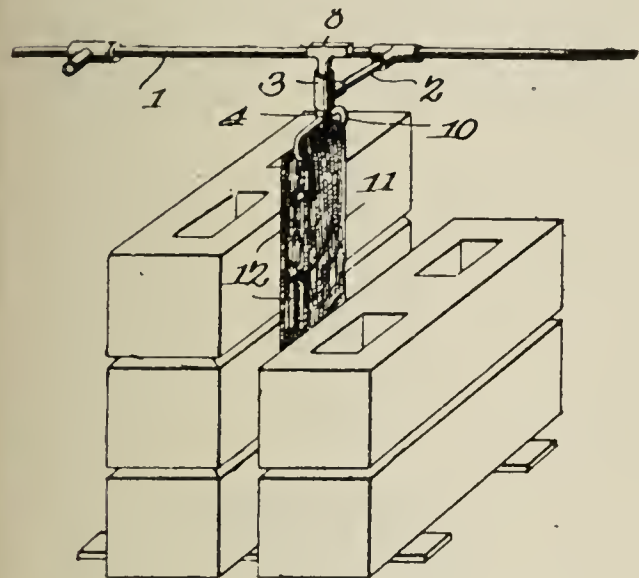
A CEMENT PLANT FOR HARVEY, IOWA.

F. E. Wear and W. E. Murlin, president and vice president of the Kansas City Portland Cement Co., have purchased 1,200 acres of land near Harvey, Marion Co., Iowa. The land contains lime stone shale and coal. W. E. Foshier of Harvey & Winfield and S. Mouse of Washington, Ia., are interested in the enterprise. A large Portland cement plant is to be erected on the land.

U. S. PATENTS RELATING TO
CEMENT AND CONCRETE.

848,726. Watering Device for Concrete Blocks. Josephine Welch and Samuel R. Minnich, Nicholasville, Ky. Filed Apr. 25, 1906. Serial No. 313,715.

Claim.—The combination with a water-discharge device; of an absorbent suspended therebelow and adapted to absorb water discharged therefrom, and means for exerting a lateral pressure upon the absorbent.

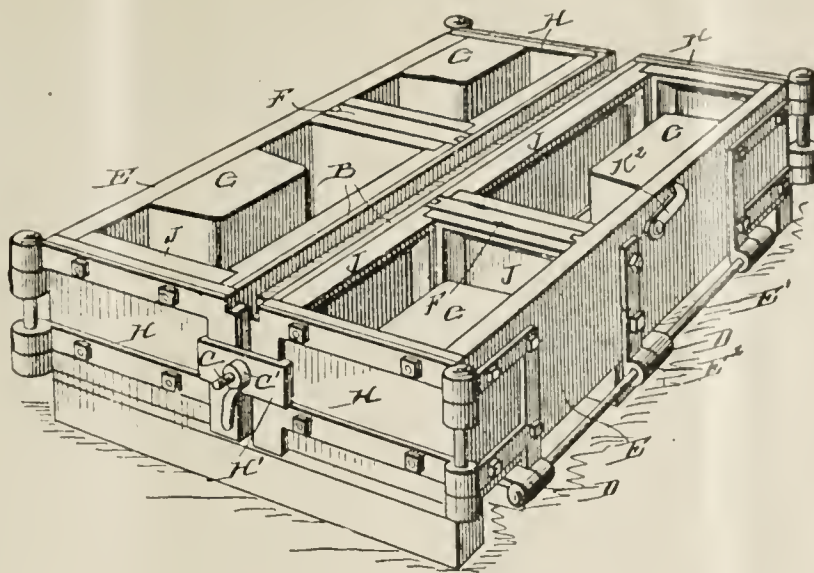


The combination with a discharge-nozzle and means for regulating the discharge of liquid therethrough; of a loop engaging the nozzle, an absorbent strip folded upon the loop and adapted to receive moisture from the nozzle.

The combination with a discharge-nozzle and means for regulating the discharge of liquid therethrough; of a loop engaging the nozzle, an absorbent strip folded upon the loop and adapted to receive moisture from the nozzle and resilient spreading devices interposed between the folds of the strips.

848,075. Metal Nosing for Concrete Steps and Other Structures. Henry H. Wainwright, Philadelphia, Pa. Filed Feb. 7, 1906. Serial No. 299,879.

Claim.—1. A nosing for concrete steps and platforms consisting of



the following members combined in one integral metal structure, viz., a body-plate adapted to protect the top of the concrete, a longitudinal corner-bar adapted to protect the top and front of the concrete, a longitudinal web adapted to enter the concrete mass at substantially right angles to said body-plate, and a head thereof adapted to anchor the nosing firmly to the concrete, substantially as described.

848,328. Cement and Process of Manufacturing Same. Maximilian Toch, New York, N. Y. Filed Oct. 23, 1906. Serial No. 340,144.

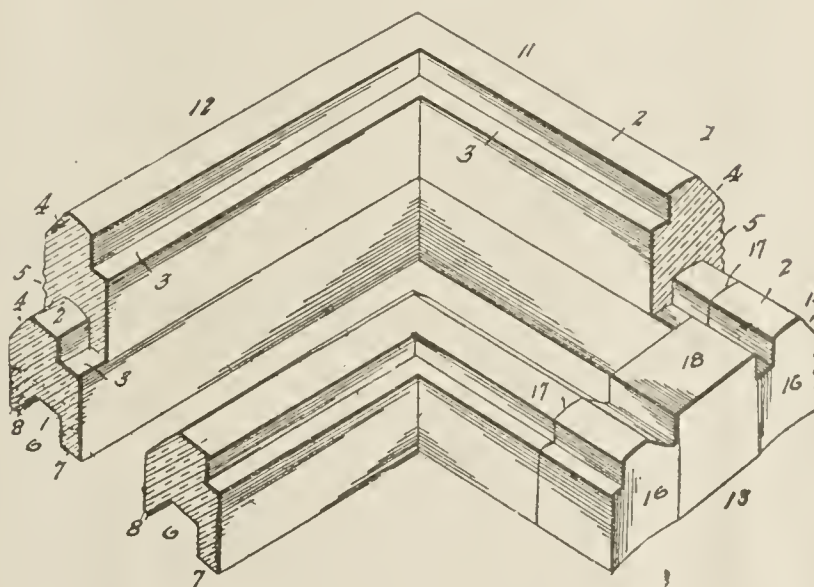
Claim.—1. The new cement, obtainable from ordinary cement in combination with a resin of an acid resin and silicate of alumina, free from voids or pores in the ce-

3. The new cement, obtainable from ordinary cement in combination with the lime resinate of Manila copal and silicate of alumina, free from voids or pores in the cement-concrete, from which bisulfid of carbon extracts resinous matter, substantially as hereinbefore described.

4. The process of making a new cement by combining a resin of an acid resin with silicate of alumina and ordinary Portland cement, substantially as hereinbefore described.

848,697. Concrete-Block Machine. Manuel Silva and Andrew Lumpp, Springfield, Ill. Filed Aug. 31, 1906. Serial No. 332,847.

Claim.—1. A concrete-building block machine comprising a base

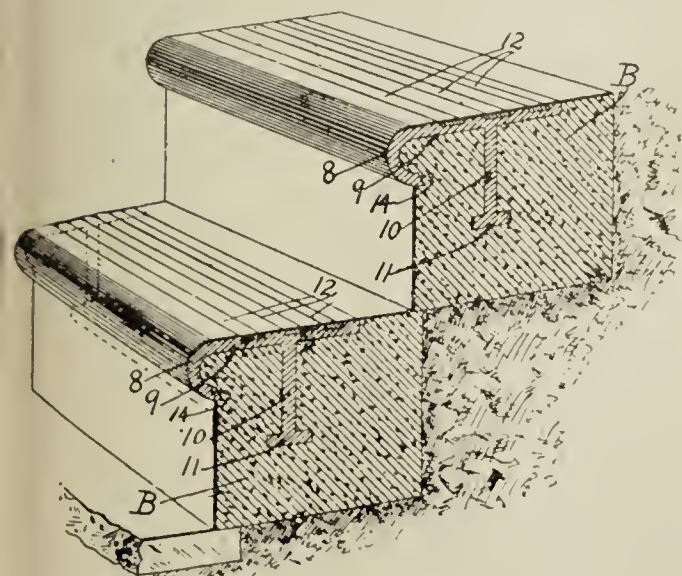


ment-concrete, from which bisulfid of carbon extracts resinous matter, substantially as hereinbefore described.

2. The new cement, obtainable from ordinary cement in combination with the lime resinate of an acid resin and silicate of alumina, free from voids or pores in the cement-concrete, from which bisulfid of carbon extracts resinous matter, substantially as hereinbefore described.

parallel partitions centrally carried by said base, hinged sides carried by the base, end gates hinged to the sides adapted to overlap the ends of the partitions, and vertical transverse partitions arranged between the partitions first mentioned and the sides, a top having cut-out portions, means for locking the end gates in a closed position, and means for locking the top to the sides.

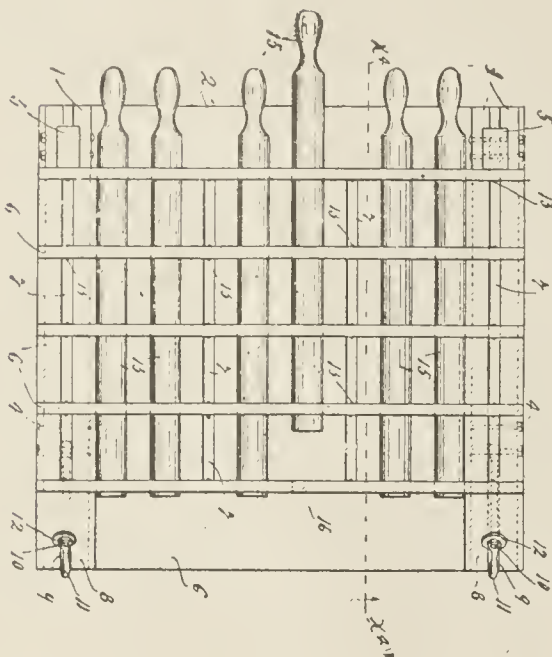
2. A building-block machine, comprising a base, centrally-arranged



partitions carried by said base spaced slightly apart, side hinged to the base, partitions adapted to be fitted between said sides and first-mentioned partitions, end gates hinged to the sides, a rod arranged between the central partitions and threaded adjacent each end, a clamping-plate adapted to fit upon said rod and engage the gate at each end of the mold, and a nut adapted to work upon each end portion of the rod and hold the clamping-plate at said end into engagement with the gates at that end, a top and means for locking the top to the sides.

847,476. Building-Block. Emery C. Hodges, Bloomington, Ill. Filed Jan. 31, 1906. Serial No. 298,781.

Claim.—1. A building construction consisting of an inner and outer wall composed of blocks having in-



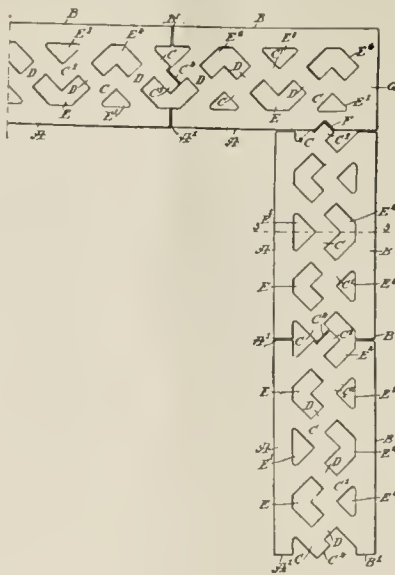
terlocking right-angled fillets and shoulders, and interlocking flaring flange and wash, and spacing-blocks between the walls having complementary fillet and shoulder, and flange and wash.

839,812. Concrete-Block Machine. Fred W. Cooley, Minneapolis, Minn., assignor of two-thirds to George T. Honstain, Minneapolis, Minn. Filed Mar. 27, 1906. Serial No. 308,302.

Claim.—1. A device for use in molding concrete blocks or bricks, comprising a plurality of flask-sections adapted to be put together to form a molding-flask and to be separated and used as palette-boards, substantially as described.

In a device of the kind described, the combination with a supporting-frame and clamping means, of a plurality of flask-sections adapted to be clamped and held thereby to form a molding-flask, and to be separated and used as palette-boards, substantially as described.

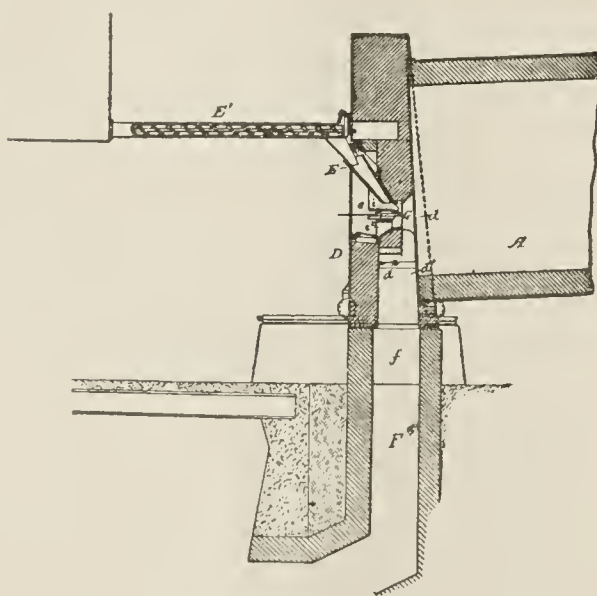
The combination with a support-



ing-frame comprising the divided supporting-bars 1 having vertical clamping-lugs 5, of a plurality of separable flask-sections 6 that are approximately L-shaped in cross-section, one of the outer members thereof having a slotted block 8, clamping-rods 10 pivoted to said supporting-bars 1 and working in threaded ends of said clamping-bolts and co-operating with said bolts to clamp the flask-sections together, the plurality of end and intermediate bolts 7 removably fitting between the upright flanges of said flask-section, and the plurality of endwise-removable cores 15 working through seats in the vertical flanges of said flask-sections 6, substantially as described.

840,893. Building-Block. John Aitken, New York, N. Y. Filed May 10, 1906. Serial No. 316,109.

Claim.—1. A building-block comprising inner and outer facing-walls and integral webs connecting the

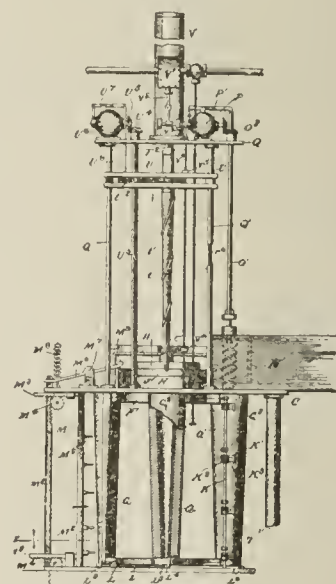


walls with each other, said webs being composed of V-shaped members projecting inwardly from the inner and outer facing-walls, the alternate members projecting from one wall and the intermediate member from the other wall, said members being connected by arms ex-

tending between the adjacent faces of the V-shaped members.

842,848. Process of Burning Cement. Charles A. Matcham, Allentown, Pa. Filed Dec. 28, 1906. Serial No. 349,809.

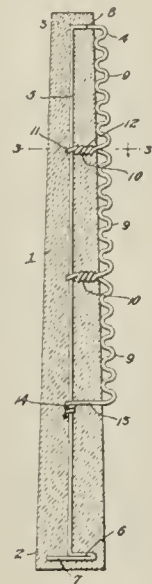
Claim.—1. The process herein described of burning cement in a substantially horizontal kiln, said process consisting in feeding the cement material into one end of the kiln and allowing it to flow from the inlet end to the discharge end thereof, feeding powdered fuel to the kiln, creating at the inlet end of the kiln a draft through said



kiln from the discharge end to the inlet end thereof sufficient to draw into the kiln the powdered fuel and a volume of air, the flame being drawn in a substantially straight path through the kiln in contact with the cement material without materially disintegrating the lining thereof, substantially as described.

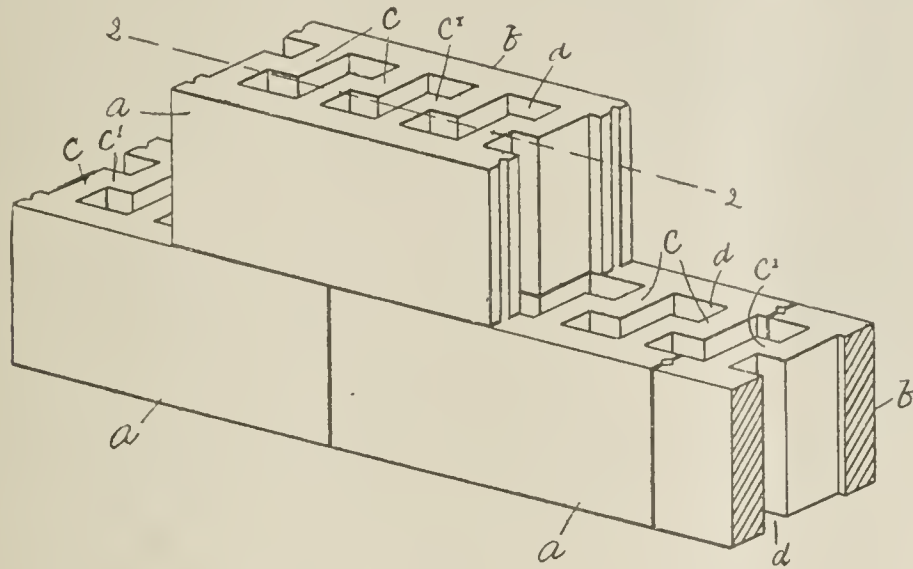
840,622. Fence-Post. Earnest B. Harris, Mount Olive, Ill. Filed Oct. 18, 1906. Serial No. 339,565.

Claim.—1. A fence-post comprising a body of plastic material and a metal frame having a portion em-



bedded in said body and a portion arranged upon the exterior thereof, the latter portion extending longitudinally of the body and being crimped continuously from end to end to provide fence-wire-receiving loops or eyes.

841,644. Machine for Making Fence-Posts. Robert L. Dennison, Kansas City, Mo. Filed Apr. 24, 1905. Renewed Aug. 1, 1906. Serial No. 328,763.



building block in various kinds of building construction, together with ornamental pieces. The machinery and moulds for producing plain and fluted columns, shafts, capitals, ornamental balls, belt courses, gables, square and round spindles, plain and ornamental chimney block and caps, porch columns, cornice blocks, concrete steps and sills. Numerous buildings are shown in which these various concrete specialties have

quarries. The output of crushed stone will be used for macadam and concrete purposes. The stone will be separated by a 48 in. by 20 ft. screen into $\frac{1}{4}$ inch in dust, $\frac{3}{4}$ inch to be used for binder and and $1\frac{1}{2}$ inch and 2 inch stone will be used as foundation. The operation of this plant will be as follows: The stone will be delivered by quarry cars to the No. 9 crusher, pass from the No. 9 machine into two elevators which will deliver the material to two 48 in. by 12 ft. screens. These screens will be quipped with 2-inch punchings full length. Everything passing through the 2-inch punchings will go on to the second sorting screen, which is 48 inches by 20 feet long.

The special feature in the design of the plant is in the storage facilities provided. Where it is usually customary to build large bins of timber to hold the crushed product, this plant will have the advantage of what is known as ground storage. A trestle work 36 feet high will be equipped with conveyor belts to carry the stone out from different points and dump it upon the ground. Through the center of this dumping pile a conduit will be built 8 feet wide by 8 feet deep. This conduit is to be covered over with 12-inch "I" beams and concrete, the "I" beams placed 2 feet apart and with bin-gates placed in the openings which will allow the stone to be delivered on to a 36-inch belt conveyor. The length of this storage pile is for the present to be about 175 feet, but will be extended in the future as fast as the stone is quarried away from the south end. This gives the company the benefit of a very large storage capacity for a small expenditure. The 36-inch conveyor will deliver the stone into a 30-inch elevator about 40-feet long, which, in turn, will deliver on to another 34-foot conveyor elevated 26 feet above the West Shore railroad tracks. The conveyor will be arranged with a tripper to deliver the stone into railroad cars on a siding and also into scows on the Hudson river. The capacity of this plant will be about 2,000 tons per day.

The combination with a suitable framing, of a carrier journaled vertically therein, vertically-disposed mold-boxes supported by said carrier, a packer extending into and filling said mold-boxes, a former for operating within said boxes upon material supplied thereto, a step-by-step feeding device for the said carrier, and intermediate mechanism whereby the former and the packer control the step-by-step movement of the carrier substantially as set forth.

844,416. Building-Block. Thomas Sewall and George M. Keene, Boston, Mass. Filed Apr. 9, 1906. Serial No. 310,701.

Claim.—1. A building-block composed of an outer wall and an inner wall and two or more partition-walls extending from said outer wall to said inner wall, each formed with an offset portion intermediate its length, whereby air-spaces are provided in the block at both sides of said partition-walls which extend from the outer to the inner walls, the air-spaces at each end of the block being one-half the size of the air-spaces within the block, substantially as described.

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The two cement plants at Iola, Kan., shipped in one day in the second week in April 147 cars of cement. This being the largest shipment of cement ever made from Iola, in any one day, and was due to a previous car shortage, one train per day being the usual shipment per day under normal conditions.

The St. Joseph (Mo.) Concrete Post & Block Company, capital \$5,000. Wm. A. Ozenberger, Jester S. Ozenberger, Arthur O. Ozenberger and Ernest Batcheler incorporators.

The Iola Cement Company's well three miles southwest of Okmulgee was shot April 17, bringing in a producer, estimated at 1,000 barrels daily.

The White Portland cement plant uncompleted is offered for sale. No reasonable offer will be refused. The plant is located near Chelsea, Mich., has upright shaft kilns, cost several hundred thousand dollars. It is reported that \$105,000 has been offered for the plant.

The Parsons Cement Co. has purchased 100 acres of land from George Pace, west of Chanute, Kansas and 20 acres of shale just north of the Pace tract. It is the purpose of the company to erect a 1,000-barrel cement mill in the near future. This is the third prospective plant at Chanute.

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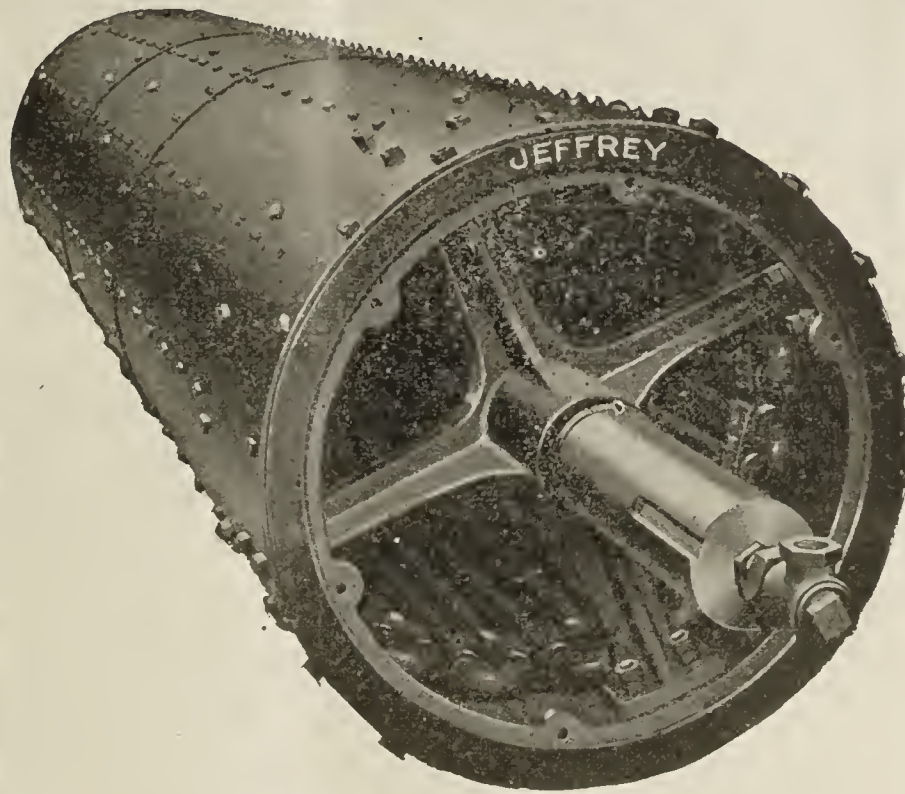
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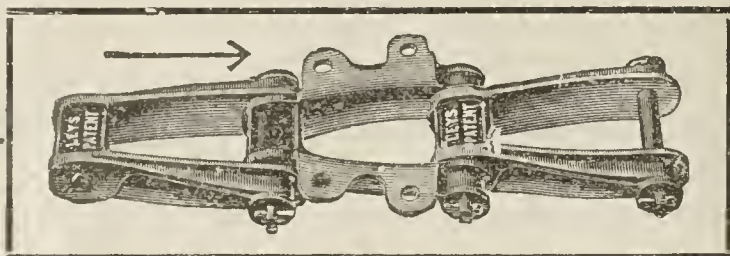
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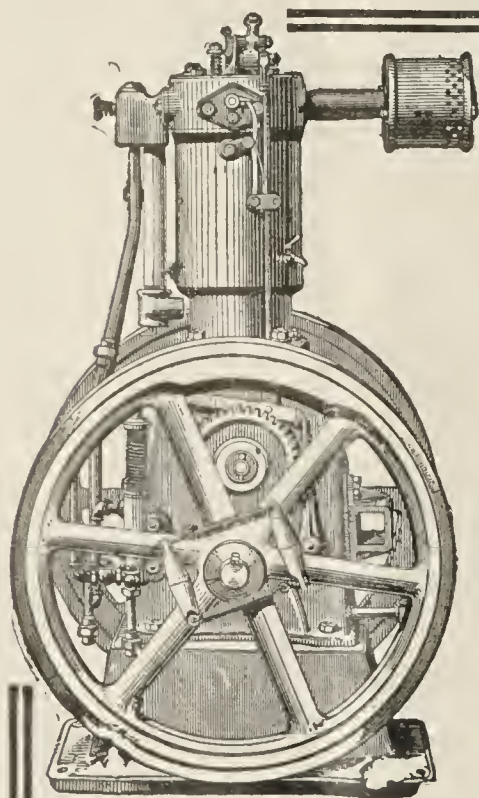
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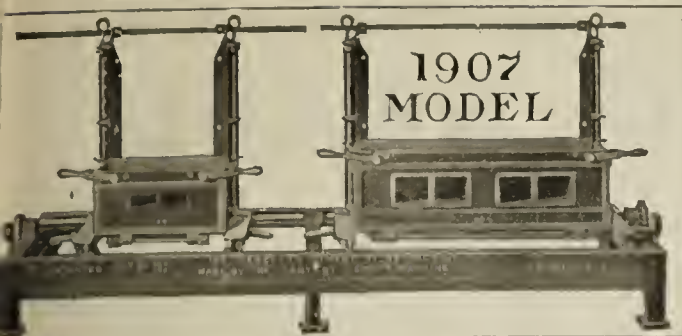
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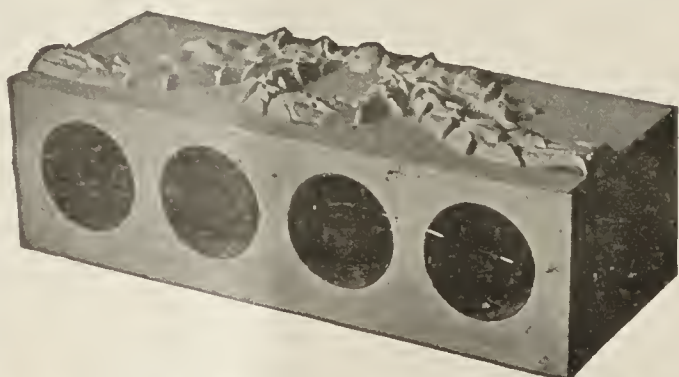
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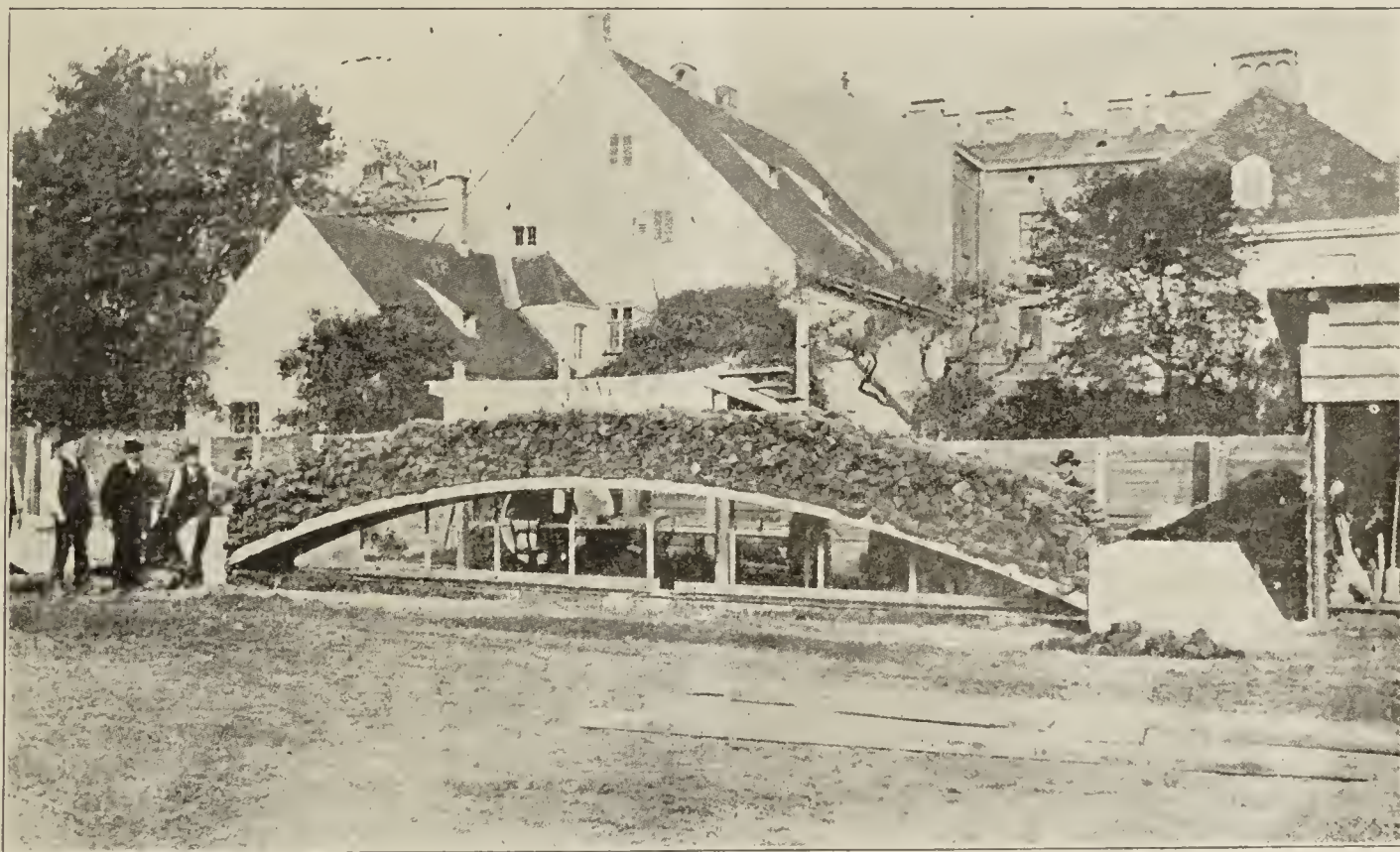
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CEMENT

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ENGINEERING NEWS



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CEMENT AND ENGINEERING NEWS

(PUBLISHED MONTHLY)

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CHICAGO, MAY, 1907.

CORRESPONDENCE.

We solicit correspondence on all matters of general interest to the cement trade in all its branches. Engineering notes, public improvements, and facts and opinions drawn from practical experiments will be welcome.

THE NATIONAL FIRE PROTECTION ASSOCIATION SPECIFICATIONS FOR CONCRETE CONSTRUCTION.

These specifications are published in this issue and should be carefully studied and followed as safe and reliable building construction as well as for the purpose of obtaining low rates of insurance. We think the fire test prescribed for cement blocks is too severe, and therefore unreasonable. Granite, which is regarded as one of the best building materials known, cannot undergo the fire test to which the concrete block is submitted. The committee's report on this subject states that concrete becomes soft under the fire test, but fail to state that this same concrete recovers its full strength again within 60 days, which cannot be said of any material used in building construction. The furnace or testing chamber in which these blocks are tested, consists of two upright walls spaced 15 to 18 inches apart and about 9 ft. high by 8 ft. wide one of these walls is formed of the concrete blocks undergoing the test, ten gas jets impinging on the face of the concrete wall, 100 cubic feet of gas being consumed in one minute. This is kept up for two hours, after which the concrete wall, which is in a steel frame forming a sliding door, this door or panel is then shoved or pulled out so as to project from one side of building. A stream of water is then caused to play upon the incandescent face of the concrete blocks and the test is recorded. Troutwine's Engineers' Pocket Book states that the heat developed from a common wood fire ranges between 800 to

11,140 degr. Fahr., while the concrete block fire test at the Underwriters' laboratory must have ranged fully 500 degrees higher than the temperature developed by common wood fire. Nine-tenths of the cement block constructed buildings will not and cannot be subjected to a higher temperature than that given for the wood fire. Why then apply the gas furnace test, prescribed by the National Fire Protection Association. The writer has seen tests made by E. L. Ransome, of concrete under boilers, a concrete bar 4x5 in. by 2 ft. long was placed in a boiler furnace and heated for 30 minutes and taken out, when it was plunged into a tank of water to cool. On cooling it was shown to be somewhat softened, so that the finger nail could be forced into it, yet in 6 weeks after it had recovered its full strength while lying on Mr. Ransome's desk, by absorbing moisture out of the air. We desire to see a block of granite placed in the wall with the concrete blocks to be tested and note its behavior under like conditions as are applied at the National Fire Protection Association laboratory. We feel assured the concrete block will come out second best.

A CHEAP ELECTRICAL CONDUCTOR.

The use of sodium for overhead transmission is attracting the attention of electrical engineers. Standard wrought iron pipes are heated up to the melting point of sodium, the sodium is then melted in kettles of special design and run into pipes, solidifying when cool. These metal sodium filled pipes are then used to conduct the electrical current. The cost of the sodium conductor is 50 per cent less than copper. A sodium conductor encased in a half in. wrought iron pipe has a capacity of 109 amperes and cost 3½ cents per foot against a copper conductor of the same capacity costing 8½ cents per foot. These figures are estimated on a basis of 7½ cents per pound for sodium and 16 cents per pound for copper. The pipe surrounding the sodium must be water proof on account of the sodium affinity for oxygen which causes it to ignite. No trouble has been experienced on this point where the pipe is protected by a water-proof coating of paint.

The Standard Lime & Stone Co., of Oakfield, Fond du Lac Co., Wis., are erecting a hydrated lime plant to cost \$10,000.

Diamonds have been discovered at Table Mountain, California, which is said will develop into the largest diamond field in the world. The claim is now being exploited by the M. J. Cooney Co., of Cherokee, Butte Co., Cal.

Elmer H. Spear of 627 Sherman street, Akron, Ohio, has just been granted a patent on a concrete conveyor. The invention consists of a metal tube conveying a bucket chain conveyor, the concrete to be elevated deposited into an elevator boat and is picked up by the buckets and conveyer to any point of the building. The cost of the outfit is \$500, and will elevate 100 cubic yards in 10 hours.

On account of the scarcity of wooden shingles, Omaha contractors have been compelled to use concrete shingles. Several dwellings built by Hastings & Heyden are being roofed with concrete shingles.

The Gibbs Cement & Concrete Block Company, Trenton—Manufacturing cement and concrete blocks; Cap., \$125,000. Incorporators: W. Gibbs, A. Bower, W. Seiger, Trenton.

Domestic Portland cement shipped to our insular possessions during the past 9 months ending March, 1907: To Alaska, 2,907 barrels, value \$9,807; to Hawaii, 3,390 barrels, value \$7,094; to Porto Rico, 80,642 barrels, value \$139,880.

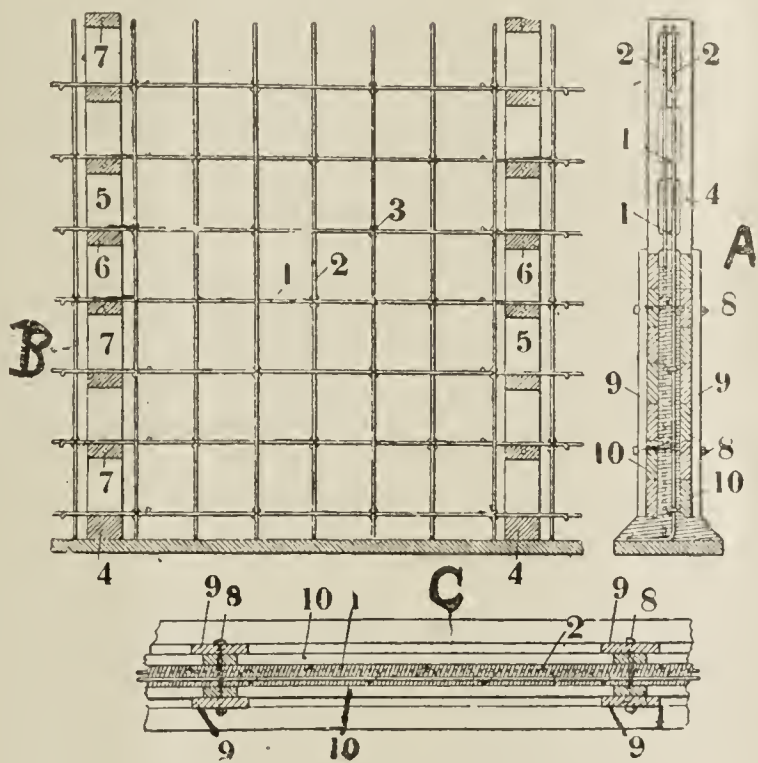
COLORING CEMENT WARE.

White cannot be produced with the ordinary Portland cement of commerce, because of the grey color which cannot be overcome. A lighter effect can be produced by the use of marble dust, which gives a fairly light color.

For yellow, use chrome powder, or ochre. For red use red oxide of iron. For brown, ground iron ore or pulverized brown stone; blue, use ultra marine; for black, use the best grade of lamp black. Free lime or even hydrated lime destroys colored cement work. It will surprise our readers when we say that the ordinary Portland cement of commerce can be made to produce a lighter finish by adding a small quantity of lamp black. All colors used in cement work should be mixed with the cement dry and brought to a uniform tint, otherwise the work will show streaks and spots. Mineral colors are the most reliable.

A SIMPLE REINFORCED CONCRETE FENCE.

Our illustrations show the plans for a new style of reinforced concrete fence. It consists of a post reinforced with two steel rods. It has seven openings shown in B. The post is finished at the factory and brought to the ground and set up. Heavy iron wire is then run through the openings from post to post as shown in Figures 5 and 6, the wire resting on the bottom of each opening and between the two rods in the post. [Fig. 1. Upright rods are then wired to the horizontal wire with No. 18 B. wire gage. After the posts are in place and in line, false work spaced the thickness of the post is erected. This false work or forms are made of 1 in. boards laid up against the sides of the post enclosing the entire span between two posts and are held in place by two board clamps overlapping the post 1-2 inches on either side forming a tongue or groove to hold the forms in place. The clamps are held in place by bolts and nuts (Fig. 8) which



pass through holes left in the post for this purpose, all as shown in cuts A and C. After the forms are in place concrete is deposited in place and tamped. A plan of the finished fence being shown in Cut C, in which Fig. 1 is the fence, Fig. 9 the wooden clamp, Fig. 8 the bolts, Fig. 10 shows the form. The post should be lengthened, cut at least from 15 to 18 inches to 90 underground to give stability to the structure. It seems to us that the size of openings in the post might be reduced as they are simply used to pass the horizontal wire through the openings and are again filled up when the concrete is being tamped to place.

COMPRESSION TESTS OF ROUND CEMENT PIPE.

According to tests made at Royal Material testing Laboratory at Gros Sichterfelde, West Germany, the strength under compression ranged for the various diameters as shown in the following table:

Inner diameter of pipe in in.'s	Thickness of walls	No. of tests	Compression test in pounding		Average
			Lowest	Highest	
8	1 3/8	3	—	—	4,554
12	1 7/8	10	3,036	16,808	9,504
16	2 1/8	22	2,880	12,464	8,118
18	2 3/16	6	7,548	9,152	8,052
20	2 3/8	21	2,816	13,614	7,754
24	2 3/4	9	4,708	13,530	7,964
28	3 1/8	12	—	—	10,120
32	3 3/8	7	5,280	8,030	7,964

A GYROSCOPE RAILWAY SYSTEM.

Mr. Louis Brennan, an English inventor, read a paper before the Royal Society of Great Britain on May 9th, and exhibited a model of a new Gyroscope railway car which travels on a single rail. The model

wire, supported in such a way that it may freely rotate about any one of the three axis. Each at right angles to the other two. When in motion the Gyroscope will maintain the direction or inclination of its permanent axis. The middle of its axis being also the center of gravity of the machine, which eliminates the action of gravitation during rotation. Thus if the axis of rotation points to a certain star in the sky it will maintain its angle of rotation notwithstanding any change of position of the machine itself, and continue to point to the same star until rotation ceases. The Gyroscope was designed by Bonenberg, in 1817 and perfected by M. Fancault in 1852 and was used to illustrate the rotation of the earth upon its axis.

The German government has installed a large Gyroscope on a first class torpedo boat. Sea trials of this craft with the Gyroscope revolving at the rate of 3,000 revolutions per minute reduced the rolling of the craft from 30 degrees to 1-2 degrees.

There seems to be a great future for the Gyroscope in the transportation of passengers and freight by land.

REMOVAL OF U. S. CEMENT TESTING LABORATORY.

The Cement Testing Laboratory of the U. S. Reclamation Service now at Denver, is to be removed to the Armour Institute, at Chicago, where free quarters have been provided by the Institute.

The work carried on by the laboratory consists principally of acceptance tests of the cement purchased for use on the construction work of various projects of the Reclamation Service and of the supervision of the shipment of this cement from the factories after the tests for acceptance have been made.

The field covered by this work includes all the projects of the service, with the exception of those situated in the Pacific Coast states, for which the supply of cement is obtained from points in California and tests of which are made at the laboratory of the engineer of soils at Berkeley, California, and also of the Salt River project in Arizona, at which point the service has a cement plant of its own for making the cement required on the project.

The specifications under which the cement is purchased conform in general to the standard specifications of the American Society for Testing Materials and the methods employed in the laboratory for making the test are in general those recommended by the committee on

car and track was operated before the Royal Society with complete success. The car was 21-2 feet wide being 1-8 of the full sized car which is to be 20 feet wide. It made short curves ascended and descended heavy grades with heavy loads on the car. Each car is provided with a double wheel Gyroscope revolving at a high speed which keeps the car erect on its single rail at high speed. The inventor claims he can make 150 miles per hour with perfect safety.

The Gyroscope heretofore has been used as a scientific toy to illustrate the phenomena which takes place in the dynamics of rotation. It consists of a fly wheel with a heavy

uniform tests of cement of the American Society of Civil Engineers, which rules are included as a part of the above named standard specifications.

In addition to the regular tests for the acceptance of material which constitutes the routine work of the laboratory, some experimental work has been carried on, such as tests of sand-cement and tests of sand and stone for concrete materials on various projects. The laboratory is also equipped with an outfit for making tests of the permeability of cement mortar under water pressure. It may be noted also that, in addition to the regular tests for tensile strength made in the laboratory, occasional sets of long-time tests are made on each brand of cement tested, these sets being for various periods running up to 10 years, and there are now over 3,000 briquettes in storage for these long-time tests. The headquarters of this laboratory has been at Denver, Colorado, since its establishment in 1904. Its removal to Chicago has been found desirable and acceptance has been made of the quarters which the Armour institute of Technology has offered to provide for it.

Thos. A. Edison is experimenting at the Edison Portland Cement Plant with a new device of his own to prevent the escape of cement dust from the kiln stocks, on account of numerous complaints from residents within 6 miles of the plant who claim that the cement dust settles on their lands and buildings injuring crops and pastures.

The company has tried many plans to catch this escaping cement, but has not been successful, notwithstanding that thousands of dollars have been spent in experiments. When Mr. Edison proposed a new device to remedy existing conditions the directors of the company declined to advance the money to install the invention, rather than to be defeated Mr. Edison agreed to advance the money himself which he did. The cement dust arrester will be installed.

NEWAYGO PORTLAND CEMENT CO. REORGANIZATION.

The Milwaukee Trust company of Milwaukee has begun suit in the United States circuit court, at Grand Rapids, Mich., for the foreclosure of a million-dollar trust deed against the Newaygo Portland Cement company, in 1899 the Cement company bonded its plant and holdings for \$1,000,000 upon which it has defaulted in the payment of interest to the amount of \$207,028.29.

It is said that 97 per cent. of the bonds are held by persons friendly to the foreclosure proceedings. While 3 per cent of the bond holders are opposed to the foreclosure proceedings. The company is making money according to President McCool and that the present proceedings were brought about after a consultation between the attorneys for the bond holders and the attorneys of the Trust Company for the purpose of heading off litigation on the part of the minority bond holders. The works will not shut down during the present litigation.

The Atlas Portland Cement company is opening up new quarries just north of New London, Mo.

The Johnson-McLean Co., of Omaha, will erect a two story planing mill in Reinforced Concrete. The company's old mill was destroyed by fire during the winter.

The Chicago Cement Stone Co., has located its plant at North Chicago, F. W. Dunn, Pres., and H. Haussmann Sec. and Treas.

The French bark Gen de Boisel-effee was chartered at Portland, Oregon, to bring a cargo of 18,000 barrels of cement from England. this makes the 24th ship chartered to bring cargoes of cement from Europe to Portland during the present season. Portland Cement importers are after more ships for the same purpose. Last season the scarcity of cement was so great, that much work was put over for this year.

The Southwestern Cement Users' Association is the name of a new organization in Topeka, Kan., whose purpose it will be to promote the cement industry and to establish a better grade of work. P. H. Forbes is chairman and O. E. Raney is secretary and treasurer.

A \$240,000 GAS LAND DEAL.

The Union Portland Cement company, with offices in the New York Life building, bought to-day from Gatlin & Gunn of Fort Scott, Kas., 2,240 acres of proved gas land near Iola, Kansas. The price was \$240,000. The deal was closed by Richard C. Patterson, general manager. Twelve wells on the tract, Mr. Patterson says, produce 25 million feet of gas daily. This is to be used in the company's mill at Iola.

The Bonnar Portland Cement Co., of Bonnar Springs Wyandotte Co., Kansas, have let contracts for its

machine shop; bids for the main plant, will be let in the near future, estimated to cost \$800,000. At a meeting of the company held at Kansas City, Mo., the following additional directors were elected: Walter B. Richardson, of the Richardson and Conover Hardware Co., Kansas City and Charles Knabb, Pres. of the First Nat. Bank of Hiawatha, Kan.

The National Portland Cement Co., of San Jose, Cal., will erect a plant in the vicinity of San Jose, Mr. R. A. McWilliams and a member of Capitalist & Construction Engineers are looking over the building site. The plans for the works have been completed and machinery selected.

Kansas City Portland Cement Co.

The new plant of the Kansas City Portland Cement Company will begin operation about June 15th with a capacity of 2,000 bbls. per day. The company was organized in 1905 and construction was begun July 1st, 1906.

The mill site is at Cement City, about ten miles northeast of Kansas City on the Missouri river bluffs, immediately adjacent to the A. T. & S. F. Ry. The supply of limestone and shale at this point is of a very fine quality and the supply is limitless.

The crusher and quarry tracks are about two-thirds of the way up the bluff. From the crusher building the raw material will be conveyed to the mill building proper by gravity. The stockhouse and loading platforms are situated within one hundred yards of a boat landing on the Missouri river which promises all that is afforded by river pockets, and a switch from the A. T. & S. F. Ry. is immediately beside the platform, assuring the quickest shipments to Kansas City offered by any Portland cement plant.

A feature of the plant is the enormous kilns—8 feet in diameter by 125 feet long. There are four of these.

The entire contract for the design and construction of the plant was awarded to the Freeborn Engineering & Construction Co. of Kansas City, Mo., who will operate it for a period of 60 days.

The officers of the K. C. Portland Cement Co. are F. E. Wear, Pres.; W. E. Murlin, Vice Pres.; W. A. Rule, Treas., and A. L. Murphy, Secy. Offices of the company are at No. 315 R. A. Long Bldg., Kansas City, Mo.

NATIONAL FIRE PROTECTION.

Advance Report of the Committee on "Cement for Building Construction."

The National Board of Fire Underwriters, through its Committee on Building Construction, has recently issued a revised edition of a Model Building Code, and is urging its adoption by municipalities throughout the country. The section (No. 110) of this Code referring to reinforced concrete construction has been revised and is submitted herewith as a practical and acceptable specification as the present state of the art will permit. It is expected that in time experience will necessitate modification or amplification of this standard.

There are three general features of this specification which the committee feel warranted especial emphasis; features which experiences of the past year or two particularly have amply proven as being those always likely to need the most careful consideration on the part of all concerned, viz.:

Design of Reinforcement: While this is a point on which there is more difference of opinion between engineers than any other, the specifications here outlined have been drawn by eminent authorities, and we believe will produce a building safe from all points of view, and will meet with as nearly universal approval as any specification which might be devised at present, and at the same time are sufficiently broad to accommodate the special features of many so-called "systems."

We would also call attention to a point omitted in the specification, namely: that the design of such buildings should be undertaken only by engineers of special training and experience along this line. Some of them alluring advertisements of patented systems of reinforcement may seem to indicate that the erection of a building using some particular design is easy, and does not require much experience, etc., but the fact is there are many intricate questions which cannot be solved by the aid of advertising text books or stereotyped specifications, and we would urge that the design of a building of this type should only be entrusted to trained engineers of recognized ability in this particular direction, just as would be the case if a steel frame building or bridge of equal importance was under consideration.

Insulation of Steel Reinforcement: In our report of 1905 this matter was discussed at some length, and the result of tests given,

which we still believe indicate the necessity of better insulation than the one inch thickness which present practice generally provides. We have no further comment to make on the basis of experimental tests, but practical experience since that time, particularly in the San Francisco fire, has amply demonstrated the need of heavier insulation.

There were thirty-one buildings involved in this great conflagration having more or less concrete construction. In most of them the concrete was used only for floor panels between steel beams, and was made, in some cases, of cinders, but chiefly of stone.

After the fire some of these floors were found in fairly good condition; that is, in cases where steel columns and girders supporting them had been sufficiently insulated from heat to stand up. In most cases, however, the protection on columns and was so thin, or frail, or of such poor material, that the steel members either collapsed or buckled so badly as to ruin many of the floor slabs.

There were no buildings involved having reinforced concrete columns, but there were several which contained beams and girders of reinforced concrete, and from these we may draw valuable lessons on this question of the insulation of steel.

1st. The Young or Seller Building, corner Market and Spear streets was a five-story structure with brick walls and steel frame with intermediate floor beams of concrete, having a most primitive type of reinforcement, which though probably not in favor anywhere at the present time, serves as an extreme illustration of the point under discussion. These beams were in effect reinforcing webs projecting from the lower face of the floor slabs and consisted of a flat rolled steel strap about 5 in. wide by $\frac{3}{4}$ in. thick, with each end hooked over the upper

flange of steel girders and bowed downward so that its centre hung about 8 in. below the lower face of the slab. On the top of this suspender strap was formed the concrete beam or web. There being no protection for the bottom or edges of the steel strap, of course, it was quickly heated up to a point where it failed to carry its load, and the floor either collapsed or was badly deformed, the amount of damage depending upon the amount of heat in different localities.

The Hall of Justice was of practically the same construction and suffered the same damage to a somewhat less degree, owing to the protection of suspended metal lath and plaster ceilings.

Construction of this type is probably a thing of the past, and would not be recognized as worthy of the term reinforced concrete. It is cited here, however, to illustrate the point that steel reinforcement needs adequate insulation.

2nd. The Johnson Building, corner of Minna and First streets, a five-story brick walled structure, occupied for harness and leather goods store. In this case the columns and main girders were of steel, but there were numerous intermediate floor beams of so-called reinforced concrete, although the reinforcement in this particular case seems to have been hardly worthy of the name. Instead of a well-selected type of steel bars made for the purpose, it seems that a miscellaneous collection of old, twisted wire and various sized rods were used, which, even if in good condition, were not heavy enough to carry their loads with safety, and, furthermore, were located not over one inch from the bottom face of the beams.

The contents of this building undoubtedly produced a hot fire, though not at all abnormal for a

IMPORTS OF CEMENT INTO THE UNITED STATES.

WHERE FROM	MARCH				NINE MONTHS ENDING MARCH			
	1906		1907		1906		1907	
	Quantity in lbs.	Value in Dollars	Quantity in lbs.	Value in Dollars	Quantity in lbs.	Value in Dollars	Quantity in lbs.	Value in Dollars
United Kingdom . .	8,245,000	\$ 24,875	25,610,776	\$ 87,604	15,176,386	\$ 46,821	218,709,040	\$ 709,418
Belgium	13,228,357	46,547	4,632,430	16,614	103,237,995	326,331	243,504,245	765,024
France	297,600	1,019	982,100	3,362	5,622,076	20,704	23,254,784	75,851
Germany	12,724,019	40,740	13,698,405	40,196	147,415,911	492,763	350,229,464	1,083,911
All Other Europe . .	—	—	—	—	296	1	20,629,070	61,741
British North Am. .	—	—	400	3	39,650	247	2,572,883	18,751
Other Countries . .	—	—	490,405	2,345	24,155	501	51,708,737	278,454
TOTAL	34,595,576	112,791	46,414,511	150,184	272,214,503	887,308	913,638,803	2,986,150
Domestic Exporters of Cement, bbls. . . .	43,696	72,271	62,505	100,703	651,870	926,747	145,032	810,755

There were 5,592,322 lbs. of imported Roman and Portland Cement, etc., in the United States bonded warehouses in March, 1906, valued at \$16,715, against 18,689,895 lbs. in March, 1907, valued at \$51,273.

For nine months ending in March, 1906, there were 52,702 tons of asphaltum imported in the United States, valued at \$237,700, against 77,036 tons imported in nine months ending March, 1907, valued at \$223,157.

mercantile house, and the result was the collapse of a portion of the building, and such a serious cracking and bending of most of the beams and floors as to render them valueless for further use. Bad design and improper insulation both contributed to the serious failure in this case.

3rd. Pacific States Telephone and Telegraph Company's main office building, on Bush street. A brick walled steel frame building, with flat gravel concrete floor slabs between beams. In the roof construction were a number of small-sized intermediate beams of reinforced concrete, having their steel members imbedded apparently about one inch from the lower surface. The upper stories of the building were filled with supplies of various kinds, and the heat was naturally severe in these upper stories, including the one immediately under the roof. These concrete beams were badly deflected, one of them failing entirely. In this case the steel columns throughout the building were insulated by 3 in. of stone concrete, and, to the best of our knowledge, were not themselves injured, although the concrete covering was naturally weakened for some distance from the surface and will doubtless have to be replaced.

Careful Workmanship: The necessity for improvement along this line has long been recognized, and here, at least, there is little possibility of disagreement as to what is needed.

The experiences of this past year have given additional proof of the gross carelessness and incompetence which have prevailed in many important works. There have been several instances of the collapse of large and expensive buildings in course of construction which have in every case been traced to neglect of well-known rules of safety. For instance, in one case the direct superintendence of the work was left to cheap help, who did not appreciate the necessity for accurate and careful workmanship, and the result was too little cement, too little water, or improper mixing, which allowed the collapse of the building wall before it was half up. In several cases the concrete has been allowed to freeze while under construction, and, naturally, it fell down on removal of forms.

The wooden molds or forms have not been properly cleaned out before receiving the concrete, with the result that shavings, blocks of wood and other refuse have been embedded in concrete in such a way as to make a vital weakness at important points in the building. Certain

steel reinforcing rods, called for by plans, have been either misplaced or omitted entirely, which together with unsafe design of original plans, caused one very serious collapse. Concrete foundations have been laid in mud, with the natural result that they failed to support the superstructures. Blocks of wood, for the purpose of holding fixtures, have been found purposely cast in the bottom of beams in such a way as to directly expose the steel reinforcement when the said block was burned or knocked out.

While calling attention to the unusual number of such failures occurring in the last year, it is only fair to admit that the number of buildings erected is also very much greater than in any previous year, and the proportion of failures may not be so much larger. Moreover, it is very encouraging to notice the extensive discussion which these failures have provoked in engineering journals, and the widespread condemnation by the public in general of the methods which have allowed these accidents, all of which must naturally tend to prevent, in some measure, the repetition of the errors in future by making it a commercial necessity for concrete builders to regulate this personal element which is especially prominent in concrete work in order to insure a sufficient degree of public confidence to secure permanence of their industry.

The section of the Building Code submitted refers especially to structures of reinforced concrete throughout, but the rules are also generally applicable to concrete floors and roofs between steel beams and girders as far as they relate to preparation and handling of the concrete itself. In such steel framed buildings concrete may safely be used for floor and roof slabs and for insulation of steel work, provided it is of the specified quality, is securely attached to the steel member by steel rods, expanded metal or woven wire and is thick enough to protect against penetration of heat, which thickness in the opinion of this Committee should be not less than 4 in. on all columns, 2 in. around and under all ordinary beams and girders, and 4 in. on the sides of large, heavily loaded girders in mercantile or storage buildings.

These rules are intended to provide for buildings of any ordinary occupancy, including mercantile or manufacturing houses or buildings subject to conflagration exposures, and we believe such structures built in strict conformity with these specifications, though not fireproof to

the last degree, will be found sufficiently fire-resistive to merit the term fireproof as generally used. This, however, is far from suggesting that concrete buildings as now being constructed are to be so regarded. The general practice at present, as already pointed out, involves too much carelessness in workmanship and too little insulation of steel work, defects which may not appear as vital under slight or moderate fire tests, but which in many cases would surely so appear, if the building were to be subjected to a long-continued hot fire, as from the burning of a stock of merchandise, or the severe attack of a conflagration.

Hollow Concrete Blocks: The past year has witnessed a wide increase in the production of these blocks for various purposes, but no important changes in method of manufacture or use.

The formulation of a standard for the manufacture and erection of these blocks has had the careful attention of this Committee, but such action has thus far been deferred in the hope that field experience and laboratory tests would develop a general line of practice which might be found both safe and practical, and we still believe that before a final conclusion can be reached as to just what materials, what shapes and sizes and methods of manufacture produce the most fire-resistive blocks, it will be necessary to await further laboratory tests, particularly those under way at St. Louis. For the present we have to report that this year's investigations of the subject have tended to strongly confirm our previously expressed view that well-made blocks are suitable for small buildings, where no high temperatures or long-continued fires are to be expected, but that the hollow form in which they are made absolutely precludes their being classed as highly fire resistive, or suitable for fire walls, or for any buildings which may be subjected to severe fire.

The extensive series of tests under the auspices of the Government at the St. Louis laboratories and our Chicago laboratories jointly are not completed, and we do not feel justified in making any extensive report on progress. However, we are at liberty to say that in the fire tests thus far made, as well as similar tests conducted for the City of Washington, D. C., practically all of the samples have been broken or cracked from unequal expansion of the various sides.

This Committee also made a similar test about two years ago, which

has not heretofore been reported, for the reason that we did not feel justified in drawing conclusions from a single trial of blocks of one type, the result, however, was concurrent with those of the other tests referred to.

The reason for such breaking is perfectly clear; concrete has almost exactly the same coefficient of expansion as steel, that is, it will expand at the rate of about .000006 of its length per degree of temperature, so that if one side of a hollow block be subjected to a severe fire long enough to heat it to several times the temperature of the other side (the connecting webs or sides being absolutely rigid and non-elastic) there must be a break between two sides. Of course, the thicker the wall or shell of a block is, the longer time will be required to heat it to the breaking point; hence, the thicker the shell, or, in other words, the nearer the block comes to being solid the less likely it is to break under fire.

This objection of breaking by unequal expansion applies particularly to the simple, hollow, box-like block which is the one by far most commonly used at present, though it also doubtless applies in large measure to the so-called two-piece blocks, whether the inner and outer pieces be tied together by metal bonds or by irregular projecting wings of the block itself. In such cases the expansion of the inner side or wall would doubtless tend to break the bond between the two and seriously weaken the wall.

One of the most recent forms of concrete block is a small solid block the size and shape of an ordinary clay brick and to be used in the same way. From the standpoint of fire resistance the only objection to be offered against such blocks is that the cement, like that in any concrete, whether in block or monolithic form, will dehydrate in time on the application of high temperatures, and they are, therefore, less fireproof than good, well burned clay brick, though it would seem that for most ordinary small buildings such small blocks may be rated as equal to common brick for walls of the same thickness.

The larger solid blocks of so-called artificial stone made of finely ground stone and cement, which are used largely for decorative purposes, would doubtless compare favorably with natural stone, and as is the case with stone, any carved or uneven surfaces would doubtless suffer similarly from heat.

While we are not prepared to submit a detailed standard for the manufacture and use of hollow

blocks, and even doubt the necessity for attempting to regulate very closely the manufacture of a type of building material which can only be recommended for low credit in fire resistance, the fact must be recognized that the material is being very extensively used and commercial necessity demands that it be given some definite grade as compared with other building materials. We, therefore, beg to state our opinion that a hollow concrete block wall is better than a frame wall for the simple reason that it is incombustible and will withstand moderate fires which would feed upon and destroy wood, but it is inferior to a brick wall on account of liability to breaking from unequal expansion, probability of continuous cracks through wall at imperfect mortar joints and especially on account of present tendency to poor workmanship in manufacture.

The regulation of this personal element of workmanship, can only come about in the course of years of experience and the recognition and control of it from our point of view will have to be left to the individual judgment of various authorities having local jurisdiction. In other respects fire resistance will be found in the block that has

1st: The thickest shell, or being nearest solid (should never be less than 2 inches thick).

2nd: That contains a good brand of Portland cement tested and found to conform to the standards of the American Society of Civil Engineers or similar specification.

3rd: That contains one part cement to not more than four parts sand or other aggregate.

4th: Is made with the wettest mixture practicable.

5th: Is most carefully cured or aged not less than thirty days before using, during which it is frequently moistened by water spray or steam.

6th: Which provides solid blocks for the course on which joists or girders rest instead of allowing said timbers to rest on or hang to the inner side of a hollow shell which may break off.

In conclusion, we would recommend the continuance of the Committee, for the purpose of collecting more complete data on various phases of the subject and reporting tests or experiences of interest, and would urge at the same time that members make a special point of informing the Committee in detail of any fires they may learn of involving concrete in any form.

Respectfully submitted,
Edward T. Cairns, Chairman.

SECTION 110 OF BUILDING CODE RECOMMENDED BY NATIONAL BOARD OF FIRE UNDERWRITERS. REINFORCED CONCRETE- STEEL CONSTRUCTED BUILDINGS.

The term "reinforced concrete" or "concrete-steel" in this Section shall be understood to mean an approved concrete mixture reinforced by steel of any shape, so combined that the steel will take up the tensional stresses and assist in the resistance to shear.

Reinforced concrete construction may be accepted for fireproof buildings, if designed as hereinafter prescribed; provided, that the aggregate for such concrete shall be hard-burned broken bricks, or terra-cotta, clean furnace clinkers, entirely free of combustible matter, clean broken stone, or furnace slag, or clean gravel, together with clean siliceous sand, if sand is required to produce a close and dense mixture; and provided, further, that the minimum thickness of concrete surrounding and reinforcing members one-quarter inch or less in diameter shall be one inch; and for members heavier than one-quarter inch the minimum thickness of protecting concrete shall be four diameters, taking that diameter, in the event of bars or other than circular cross-section, which lies in the direction in which the thickness of the concrete is measured; but no protecting concrete need be more than four inches thick for bars of any size; and provided, further, that all columns and girders of reinforced concrete shall have at least one inch of material on all exposed surfaces over and above that required for structural purposes; and all beams and floor slabs shall have at least three-quarters inch of such surplus material for fire-resisting purposes; but this shall not be construed as increasing the total thickness of protecting concrete as herein specified.

All the requirements herein specified for protection of steel and for fire-resisting purposes shall apply to reinforced concrete filling between rolled-steel beams, as well as to reinforced concrete beams and to entire structures in reinforced concrete. Any concrete structure or the floor filling in same reinforced or otherwise, which may be erected on a permanent centering of sheet metal, of metal lathing and curved bars or a metal centering of any other form, must be strong enough to carry its loads without assistance from the centering, unless the concrete is so applied as to protect the centering as herein specified for metal reinforcement.

Exposed metal centering or ex-

posed metal of any kind will not be considered a factor in the strength of any part of any concrete structure, and a plaster finish applied over the metal shall not be deemed sufficient protection.

All concrete for reinforced concrete construction whenever used in such buildings must be mixed in a machine which mixes one complete batch at a time, and entirely discharges it before another is introduced. At least twenty-five complete revolutions must be made at such a rate as to turn the concrete over at least once in each revolution for each bath.

Before permission to erect any concrete-steel structure is issued, complete drawings and specifications shall be filed with the Commissioner of Buildings, showing all details of the construction, the size and position of all reinforcing rods, stirrups, etc., and giving the composition of the concrete.

The execution of work shall be performed by workmen under the direct supervision of a competent foreman or superintendent.

All forms and centering for concrete shall be built plumb and in a substantial manner with inside surfaces smooth and made tight so that no part of the concrete mixture shall leak out through joints, cracks or holes, and after completion shall be thoroughly cleaned out, removing shavings, chips, pieces of wood and other material, which should not be permitted in forms.

The reinforcing steel shall be accurately located in the forms and secured against displacement while the concrete is being placed and tamped.

Concrete shall be placed in forms as soon as practicable after mixing, and in all cases immediately after the addition of water.

Whenever fresh concrete joins concrete that is set, or partially set, the surface of the old concrete shall be roughened, cleaned and thoroughly slushed with a grout of neat cement and water.

Concrete shall not be installed in freezing weather; such weather shall be taken to mean a temperature of thirty-two degrees Fahrenheit or lower; concrete shall not be allowed to freeze after being put in place, and, if frozen, shall be removed.

The time at which forms and centering may safely be removed will vary from twenty-four hours to sixty days, depending upon temperature and other atmospheric conditions of the weather; the time for such removal to be determined by the Commissioner of Buildings.

The concrete shall be mixed in the proportions of one of cement,

two of sand and four of other aggregates as before provided; or the proportions may be such that the resistance of the concrete to crushing shall not be less than 2,000 pounds per square inch after hardening for twenty-eight days, but for reinforced or plain concrete columns the mixture shall not be leaner than one part of cement, two of sand and five of the coarser aggregate in any case. The tests to determine this value must be made under the direction of the Commissioner of Buildings. The concrete used in concrete-steel construction must be what is usually known as a "wet" mixture.

Only high-grade Portland cements shall be permitted in reinforced concrete-steel constructed buildings. Such cements, when tested neat, shall, after one day in air, develop a tensile strength of at least 300 pounds per square inch; and after one day in air and six days in water shall develop a tensile strength of at least 500 pounds per square inch; and after one day in air and twenty-seven days in water shall develop a tensile strength of at least 600 pounds per square inch. Other tests, as to fineness, constancy or volume, etc., made in accordance with the standard method prescribed by the American Society of Civil Engineers, may, from time to time, be prescribed by the Commissioner of Buildings.

The sand to be used must be clean, sharp grit sand, free from loam or dirt, and shall not be finer than the standard sample kept in the Department of Buildings.

The stone used in the concrete shall be a clean, broken stone, of a size that will pass through a three-quarter inch ring, or good gravel may be used in the same proportion as broken stone, or broken hard bricks, or terra-cotta, or furnace slag, or hard clean clinkers may be used.

The steel shall meet the requirements of Section 21 of this Code.*

Concrete-steel shall be designed in accordance with the following assumptions and requirements:

(1) The adhesion between the concrete and the steel is sufficient to make the two materials act together; the unit value of the adhesion is at least equal to the unit shearing strength of concrete.

(2) The design shall be based on the assumption of a load four times as great as the total working load (ordinary dead load plus ordinary live loads) producing a stress in the steel equal to the elastic limit, and a stress in the concrete equal to two thousand pounds per square inch.

(3) The modulus of elasticity of concrete at two thousand pounds per square inch is equal to one-eighteenth of the modulus of elasticity of steel.

(4) The steel takes all the tensile stress.

(5) The stress-strain curve of concrete in compression, when the stress in the extreme fibre is two thousand pounds per square inch, may be assumed.

(a) As a straight line.

(b) As a parabola with its axis vertical and its vertex on the neutral axis of the beam, girder or slab, or

(c) As an empirical curve with an area one-quarter greater than if it were a straight line, and with its centre of gravity at the same height as that of the parabolic area assumed in (b).

(6) The assumption belonging to the common theory of flexure, where not modified by any of the foregoing, will apply.

In the design of structures involving reinforced concrete girders and beams, as well as slabs, the girders and beams shall be treated as T-beams, with a portion of the slab acting as flange, in each case. The portion of the slab so acting shall be determined by assuming that in any horizontal-plane section of the flange, the stresses are distributed as the ordinates of a parabola, with its vertex in the stress-strain curve and with its axis in a longitudinal vertical plane through the centre of the rib of the T.

The shearing strength of concrete, corresponding to a compressive strength of two thousand pounds per square inch, shall be assumed at two hundred pounds per square inch.

All reinforced concrete T-beams must be reinforced against the shearing stress along the plane of junction of the rib and the flange. Where reinforced concrete girders carry reinforced concrete beams, the portion of the floor slab acting as flange to the girder must be reinforced with bars near the top, at right angles to the girder, to enable it to transmit local loads directly

*Section 21. Steel. All structural steel shall have an ultimate tensile strength of from 54,000 to 64,000 pounds per square inch. Its elastic limit shall be not less than 32,000 pounds per square inch and test specimens, ruptured in tension, must show a minimum elongation of not less than 20 per cent. in eight inches. Rivet steel shall have an ultimate strength of from 50,000 to 58,000 pounds per square inch.

to the girder and not through the beams, thus avoiding an integration of compressive stresses due to simultaneous action as floor slab and girder flange.

Concrete indirect compression shall not be stressed, under the working load, more than three hundred and fifty pounds per square inch. Reinforced compression members shall be designed on the assumption that this stress in the concrete will be simultaneous with one of six thousand pounds per square inch in the steel. Should the use of hooped concrete be proposed, the working stresses will be a subject of special consideration by the Commissioner of Buildings.

In the execution of work in the field, work must be so carried on that the ribs of all girders and beams shall be monolithic with the floor slab.

In all reinforced concrete structures, special care must be taken with the design of joints to provide against local stresses and secondary stresses due to the continuity of the structure.

In the determination of the bending moments due to the external forces, beams and girders shall be considered as simply supported at the ends, no allowance being made for continuous construction over supports. Floor plates, when constructed continuous and when provided with reinforcement at top of plate over the supports, may be treated as continuous beams, the bending moment for uniformly distributed loads being taken at not

less than $\frac{WL}{10}$; the bending mo-

ment may be taken at $\frac{WL}{20}$ in the

case of square floor plates which are reinforced in both directions and supported on all sides.

When the shearing stresses developed in any part of a reinforced concrete or concrete-steel constructed building exceed under the multiplied loads the shearing strength as fixed in this Section, a sufficient amount of steel shall be introduced in such a position that the deficiency in the resistance to shear is overcome.

When the safe limit of adhesion between the concrete and steel is exceeded, provision must be made be made for transmitting the strength of the steel to the concrete.

Concrete-steel may be used for columns in which the ratio of length to least side or diameter does not

exceed twelve. The reinforcing rods must be tied together at intervals of not more than the least side or diameter of the column.

The contractor must be prepared to make load tests on any portion of a reinforced concrete or concrete-steel constructed building within a reasonable time after erection as often as may be required by the Commissioner of Buildings. The tests must show that the construction will sustain a load with a factor of safety for floors and structural members as required by Section 136 of this Code.*

*Section 136. Factors of Safety. Where the unit stress for any material is not prescribed in this Code the relation of allowable unit stress to ultimate strength shall be—

As one to four for metals, sub-

As one to four for metals, subjected to tension or transverse stress;

As one to six for timber,

And as one to ten for natural or artificial stones and brick or stone masonry.

But wherever working stresses are prescribed in this Code, varying the factors of safety herein above given, the said working stresses shall be used.

PROGRESS OF THE UNITED STATES.

In 1800 the population of the U. S. was 5,308,483, and the area 827,844 square miles; in 1860 the population increased to 31,443,321, and the area to 3,026,789 square miles; in 1906, the population was 84,154,009. The wealth per capita in 1850 was \$513.93; in 1906, \$1,310.11; debt per capita, \$11.46. Gold coin in circulation, \$668,655,075; silver in circulation, \$188,630,872. Gold certificates in circulation, \$516,561,846; silver certificates in circulation, \$471,520,054. U. S. notes outstanding, \$335,940,220; national bank notes outstanding, \$548,001,238. Sugar consumed, 2,864,013 tons. Miles of railway operated, in 1905, 217,341 miles. Passengers carried, 745,446,641. Number of passenger cars, 30,777; other cars, 1,767,657. Salaries paid to school teachers, \$177,462,081. War department expenses, \$117,946,692; navy, \$110,474,264. Deposits in savings banks, \$3,299,544,601; in National banks, \$4,055,873,637. Internal revenue receipts, \$249,150,213; custom, \$300,251,878. Net ordinary receipts, \$594,454,122. Manufactures exclusive of hand trades, \$14,802,147,087.

The bank clearings of New York in 1906 were \$103,756,100,091; of the entire country, \$157,749,328,913.

The White Star Line Steamer Adriatic is the largest steamer afloat, being 725 feet 9 inches long, 50 foot deep and 75 ft. 6 inches beam, 25,000 gross tonnage, and displacement, 40,000 tons. The craft is built for comfort and great tonnage. It will take 8 days to make the voyage from New York to Liverpool.

The stockholders of the Empire Portland Cement Company met in annual session at the company's office at Warner, N. Y., May 7.

The following members of the Board of Trustees were re-elected: President, General Charles Miller; vice-president, George C. Miller; secretary and treasurer, J. B. Moorhead, all of Franklin, Pa. H. S. Hayden of this city was re-elected manager for the coming year.

At an adjourned meeting of the creditors of the Reading Cement Company, Referee S. E. Bertolet decided that the bond holders representing a claim of \$137,000 were not entitled to a participation in the distribution of the estate as its committee claimed.

The Southern California Cement Company's plant at Crestmore, Riverside County, Cal., is well under way. The foundations for the building and machinery are about completed. The superstructure will be commenced before June 1st. The siding connects with three transcontinental railway lines. The machinery for the plant has been arriving for some time. A town site allotment owned by the Winton & McLeod Co., of Los Angeles. The town of Crestmore is not yet listed in the U. S. Postal Guide. The company has expended \$300,000 to date on the plant.

An order shipped March 3, 1907 of Hercules Concrete Block Machines weighed a little over eighteen tons. The same week three machines were shipped to Ireland and two to Porto Rico. The Century Cement Machine Company of Rochester, N. Y., makers of the Hercules report a large increase in domestic as well as foreign orders.

A CONCRETE MOTOR LINE.

We illustrate a concrete track and motor cars to be used for conveying passengers on public highways, the summer and winter cars being shown. These cars travel on two concrete walls shown in Fig. 2. The two rails are connected by cross bars "a" and rails "b;" the motor car wheels rest on "b;" the flanges "c" serve to keep the wheels on the

space between the track will be filled in with earth or stone ballast. The cars will be propelled by ordinary automobile engines. The cost of track construction and equipping the line with cars will be very economical compared with the ordinary trolley lines. There will be no power house poles or wire conductors, as each car will develop its own power. The system in fact will be

fore the public. Such a line would form a suitable feeder or side line for trolley lines as well as for ordinary steam railways.

Advantages of the New Invention.

1. It can be built, and well built, for half the original cost of an interurban.

2. It can be operated at half the cost.

3. It can be built into localities where an interurban can not be made to pay.

4. It will connect towns situated fifteen or twenty miles from interurban lines with the same, and become a feeder to such lines.

5. It will make every county seat a motor line center as the state capital is now an interurban center.

6. It dispenses with power house, overhead trolley, wooden cross-ties, steel rails, and when once laid will last a hundred years.

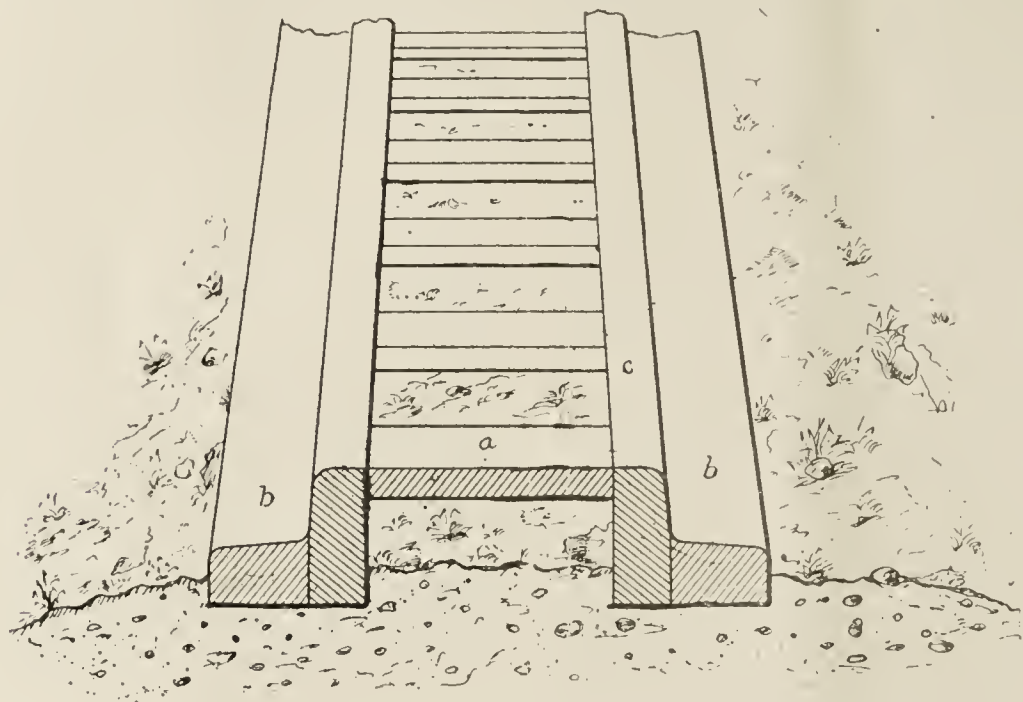
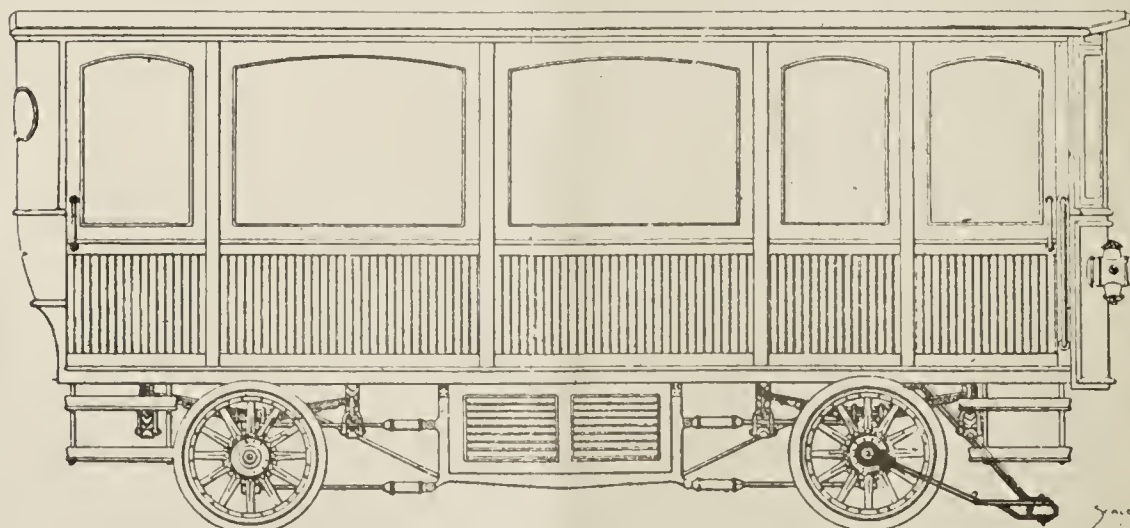
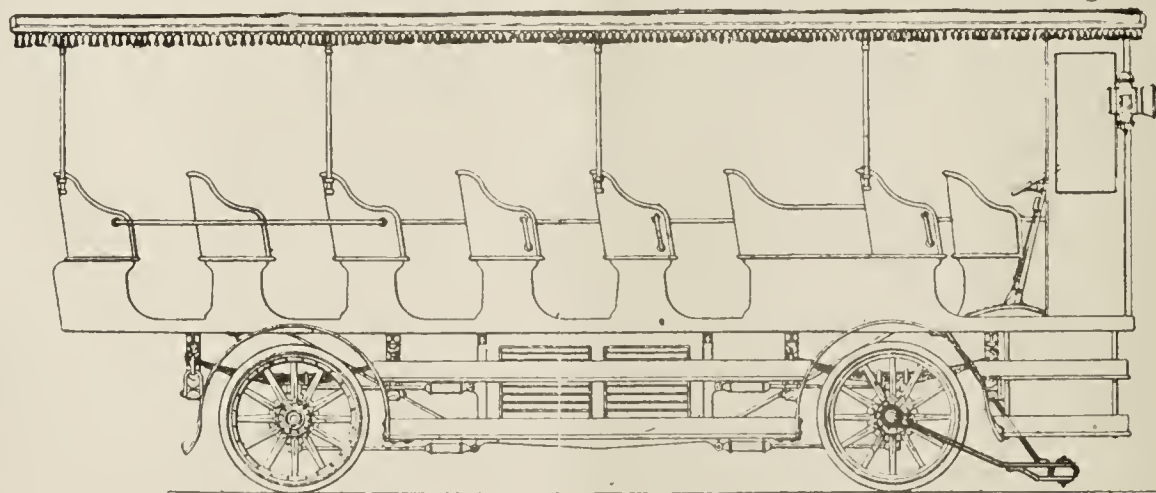
7. If the bill becomes a law arrangements have been made to build a line from Seymour to Brownstown as soon as the season opens.

8. As the session is rapidly approaching an end, any help you can render to facilitate the passage of the above bill will be highly appreciated.

A Portland Cement plant at Humboldt, Kan., is said to be assured.

track by lateral friction wheels, which at the same time prevent the perpendicular wheels from touching the flange "c." The track will be built in sections and cemented by steel rods, which serve to keep the track in perfect alignment. Each car will seat 28 passengers. The

an automobile line running on its own tracks without interfering with the ordinary vehicle traffic on country roads. On the contrary it will improve the country highway, the road bed answering for a paved way. Mr. Z. T. Sweeney, of Columbus, Ind., is placing this system be-

**SUMMER CAR.****WINTER CAR.**

WATERPROOFING CONCRETE BLOCKS.

There are a number of compounds on the market for waterproofing concrete, especially concrete building blocks, which are more or less porous in their natural state, however carefully the blocks may be made, therefore waterproofing is absolutely essential for external walls in concrete block construction. Our illustration shows the effect of blocks treated with waterproofing, and untreated blocks made from the same mixture. These blocks were stocked in the yard and photographed after a severe rain storm. The blocks on the left are dark, being saturated with water while the

it fails. The Medusa Compound retains its efficiency when many of the others fail.

THE COWHAM McCOURTIE SYNDICATE NEW PLANT AT DALLAS, TEXAS.

The above named syndicate will erect a \$4,000 barrel Portland Cement Plant at Dallas, Tex., where 264 acres of land have been purchased five miles west of Dallas, between the tracks of the Texas Pacific and the proposed Texas Northern Railways. The Dallas-Fort Worth Interrurban Railway likewise passes near the mill site, while a siding connects the mill with the

ated under the laws of West Virginia with a capital of \$3,500,000, of which \$1,750,000 will be 7 per cent. preferred stock and \$1,750,000 common. The entire issue is fully paid and non-assessable. The preferred stock will be issued from time to time at the option of the board of directors. The 7 per cent. interest will commence on July 1, 1908, on the preferred shares. These preferred shares may be redeemed at any time at par value on and after July 1, 1913. The rating power of the preferred and common stocks are equal. The purchase of each share of preferred stock carries with it one-half share of common stock as a bonus, the remainder of the



Waterproof and Plain Untreated Concrete Blocks

blocks on the right treated with a 10 per cent. waterproof compound, shed the water like the feathers on a duck's back, being perfectly water rejecting. These blocks were made by the Pettyjohn Company of Terre Haute, Ind. The one per cent. compound used in the treated block was the Medusa, which is being extensively used throughout the country for waterproofing concrete roofs and roof tiles, bridge floors and all classes of concrete work in which waterproofing is required.

The Medusa compound is now more extensively used than any other compound which is mixed with the concrete before the block is moulded, either in the exposed face or external surface of the wall or throughout the entire mass of the block. The trouble with much of the waterproofing now on the market is that its effect is only temporary, deteriorating with age, when

Santa Fe Railway, thus insuring good shipping facilities.

The company's land carries an inexhaustible supply of raw cement material, lime stone and high grade shale, all of which has been examined by the company's experts and pronounced first class.

The company has under investigation the use of producer gas for fuel. No decision in this matter has yet been reached. The Gulf Oil Pipe Line passes through the company's land, while the Texas Oil Tank Farm is within gun shot of the mill site. The fuel problem is giving no trouble, while the extensive coal fields in the Indian Territory and Texas are conveniently located to supply the company with fuel to be used either as powdered coal or to be converted into producer gas. The company will be known as the Southwestern Portland Cement Company, incorpor-

common stock being reserved for the promoters of the enterprise. Whenever the preferred stock is retired the holder receives the principal plus seven per cent annual dividends, still retaining the 50-cent common stock; thus the control of the company's affairs will be gradually transferred to the holders of the common stock, this control becoming absolute when all of the preferred stock is retired. The company will erect a first class plant, which will be pushed to completion in short order after the ground is broken.

The officers of the company are as follows: W. F. Cowham of Jacksonville, Mich., president and head of the Cowham Syndicate; A. C. Stich, president of the Citizens National bank of Independence, Kan., vice-president; W. A. Porter, president of the City National bank of Jackson, Mich., treasurer; W. H.

L. McCourtie of Minneapolis, secretary, and W. H. Hamley, a banker of Huntington, Ind.

The Cowham-McCourtie syndicate operates six cement plants as follows: The Peninsula Company of Michigan, the National Portland Cement Company of Ontario, Canada, the International Cement Company of Quebec, the Southern States Cement Company of Georgia, the Western States Cement of Kansas, and the Northwestern States Cement Company of Iowa. In the six companies named over \$10,000,000 is invested.

The syndicate has general offices in Jackson and Minneapolis, and will at once make Dallas a third headquarters.

METHODS OF CREOSOTE ANALYSIS USED FOR PRESERVING TIMBER.

The growing scarcity of lumber and consequent high prices demands that more attention be paid to prolonging the life of timber by means of preservative processes, coal, tar, creosote being regarded as the most efficient wood preservative. This product varies in composition, due to the differences in the coal used as well as the methods employed in their distillation, as the different compositions of creosotes have different values as wood preservatives. The analysis of these oils is therefore important, as only a limited amount of study has been given to perfecting methods of creosote analysis. The United States Forestry Service has taken up the matter in the interest of wood preservation.

The most important part of a creosote analysis is the fractional distillation, since by this operation an approximate determination is made of the relative proportions of the most important substances in tar oil. There has been considerable divergence of opinion as to the best way of carrying out the fractionation of tar oils, some recommending a retort as a distilling vessel and certain temperatures for taking fractions, others recommending a distilling flask and a different set of temperatures.

Laboratory experiments carried on by the service have shown that the difference in the weights of the fractions obtained when using different sorts of distilling vessels are not large, but that the composition of the fractions indicate a little better separation by the flask than by the retort. As regards the influence of the rate of distillation, variations of from one to three drops per second have but slight influence on the

weights of the fractions, though the slower rate is more satisfactory.

It is commonly believed that the relative amounts of light oil, naphthalene and anthracene oil are the most important factors determining the value of a creosote for wood preservation. A number of creosotes were very carefully fractioned and determinations made of the amounts of naphthalene and solid anthracene oil distilling between various temperatures. The average of the results shows that at least twenty-five per cent of naphthalene was present in the distillate between 205 degrees and 250 degrees C., and that over twenty-five per cent of the anthracene oil solids are present in the distillate above 300 degrees C. Work on the specific gravity and the index of refraction of the distillates between different temperatures is now being carried on.

The desirability of getting the criticisms and suggestions of users of creosote has led to the publication of a detailed account of the methods employed in the experiments and the results which have been obtained. Those who desire the publication should ask for Circular 80, Fractional Distillation of Coal Tar Creosote. Request should be made to the Forester, Forest Service, Washington, D. C.

REINFORCED CONCRETE IN- FRINGEMENT SUIT IN ENGLAND.

In a suit brought by Mouchel vs. Edmond Coignet, Cowlin & Sons and C. G. Workman in England for infringing the patent granted to Francois Hennebique on reinforced concrete piles, the defence claimed lack of novelty in the invention. It was conceded that concrete piles were unknown in England before the Hennebique patents were granted for such pile, but that the strength of concrete was known and had been applied in building construction and that the plaintiff's invention was simply the application of the material to another purpose, constituting no new invention and that such an application had been anticipated. Mr. Justice Warrington decided that the patent was a new manufacture, a pile capable of being driven and of particular construction and material, and contained sufficient invention upon which a patent could be based, and that there was no anticipation of the invention and declared the patent valid, that Cowlin & Sons were

infringers, an injunction was granted against Cowlin & Sons with cost. The case against the other defendants was dismissed. Messrs. Cowlin & Sons entered an appeal, which was allowed by The Lord Chief Justice, who said that counsel for the plaintiffs put a very narrow construction on the patent—namely, that it was simply a patent for a pile constructed in the particular way shown in the specification and drawings. His Lordship, however, said he had come to the conclusion that it was impossible to put on it this narrow construction. The greater part of the argument, however, had gone on the ground that the merit of this invention was the bringing to the notice of the public that a vertical pile could be used for the purpose of a pile mentioned in the specification—that was a pile which was capable of being driven into the ground. He thought that it was impossible to treat that as being an invention which could be made the subject of valid letters patent if all that the plaintiff had done had been to point out that a particular construction could be used in a particular way. If they were to adopt this argument, it would be open to attack on the ground that this was really discovery, not invention; but the great difficulty that he felt in adopting this wide view was that in that case it seemed to him impossible to distinguish between this construction of this specification and the construction of earlier specifications. In his opinion the earlier specifications had brought additions to the stock of common knowledge, such as made it impossible for the plaintiff to put this wide construction on his patent. On these grounds, therefore, his Lordship thought that the appeal ought to be allowed. The Lords Justices also delivered judgments allowing the appeal.

The Central Freight Association has increased the tariff on cement entering Chicago from points 250 miles distant, for which the rate has been 4 cents per 100 pounds. This rate will be increased to about 5 per cent of the sixth class rate, which will raise the rate from one-quarter to one per cent per 100 pounds.

E. C. Hener, an undertaker of New London, Wis., has invented a reinforced concrete burial vault which he is manufacturing. Claiming it to be air tight and water proof.

SOUTHERN CALIFORNIA CEMENT COMPANY.

Architect John C. Austin, of Los Angeles, Cal., has completed plans for a large office and hotel building to be erected for the Southern California Cement Company, as one of the preliminary features of its project to establish a cement plant three and a half miles northwest of Riverside.

This building will be of two stories and will contain a laboratory, besides offices and quarters for the men at present employed there. Two hundred men are grading, excavating and laying foundations for the plant.

The company is financed and controlled by William G. Henshaw, of Oakland, Cal.

The machinery for the plant was purchased in October of last year, and shipments are due on the ground within the next thirty days. By the end of this month 400 men will be at work. The town-site, called Crestmore, is owned by a syndicate represented by Winton & McLeod, of this city.

The Whittier National Bank and the Home Savings Bank are now in their new building. They have one of the handsomest banking houses in Southern California.

CONCRETE POULTRY HOUSE FLOOR.

Ed. Cement & Engineering News: Will you please give directions for constructing a concrete floor for a poultry house? G. S. J., R. R. 4. Wabash, Ind.

Excavate 6 or 8 in. Fill in with cinders or gravel for foundation, tamp solid as possible or flood the same with water. Make a concrete, one part Portland cement to 8 of sand and gravel, deposit the concrete 2 inches deep. Level off the work. Finish with a mortar, 1 Portland cement to 3 of sand and gravel. Trowel to an even surface and finish by drawing a flat brush over the troweled surface to remove all trowel marks. Cover the floor after 24 hours old with fine sand $\frac{1}{2}$ in. deep. In seven days cover the sand with ordinary soil, sprinkle with sut straw or chaff.—Ed.

Mr. J. R. Fulkedson of Jerseyville, Ill., a practical farmer and a member of the Illinois state highway commission in an address before the State Farmers' Institute, said, farmers should throw away your

road grading machinery and replace with the split log road drag.

Since ninety-five per cent of the roads in Illinois are dirt roads, let us use the road drag, and make the best roads possible out of what we have naturally.

Whenever a little wooden bridge wears out, or rots out, replace it with a concrete culvert, and thus have something permanent.

Consult with the state highway engineer; you can do so with advantage upon the question of bridges or highway construction.

Preparatory to increasing its shipment by water the Elk Rapids Cement Co., is enlarging and improving its docks. The company expect to ship in this way at least 135,000 barrels of cement during the coming season.

Brandon, Manitoba, Canada, is asking for bids on 6,000 to 8,000 barrels of Portland cement to close April 11, 1907. For specifications and form of tender address W. H. Shillinglow, City Eng., Brandon, Manitoba, Canada.

The Bonnot Company of Canton, Ohio, report business in the cement machinery line as extremely good. Among the recent contracts taken by this company are the equipment for the plant of the San Juan Portland Cement Company of Chittenden, California and the Chanute Cement & Clay Product Company of Chanute, Kansas.

DEMAND \$4 A DAY.

Syracuse, N. Y., sidewalk contractors have received notice that a union or association of cement walk finishers is being organized and that a demand will be made for an increase in pay from \$3.50 to \$4 a day. There are, it is said, twenty finishers in the city.

Cornelius Sullivan, one of the contractors, said to a Herald reporter to-day:

"A man who is interested in the matter has gone to Toledo and Milwaukee to get finishers who are willing to work at the prevailing wages. That is all I have to say about it."

One of the interested parties said: "The men want \$4 a day straight time whether they work or not and 50 cents an hour for overtime. They want double price for Sunday work.

We paid \$3.50 and \$3.75 a day last year. The helpers, we understand, have got to work three years at the business before they are eligible to membership in the union. Sometimes the men lay down on us and their services are lost for the time."

The U. S. Gypsum Co. has renewed an order for 249 cars of gypsum for San Francisco, which will be shipped from Blue Rapids, Kansas.

A NEW ARTIFICIAL STONE PRODUCT.

Artificial stone from blast furnace slag and lime is now being made as follows: The slag is reduced to a fine powder in a Cyclone pulverizer; seven parts quick lime is added to the ground slag and mixed to a pasty mass, which is run into metal moulds and subjected to heavy pressure which consolidates the mass and expels most of the water. The blocks or forms are then dried and placed in iron cylinders, which are sealed. The air is then exhausted. Carbonic acid is then introduced and allowed to permeate the stone for three days. The lime takes up the carbonic acid gas which binds the mass together, forming a solid substance hard and durable. Artificial marble is made under the same process, the materials being slightly changed. Calcined lime and magnesia in quantities varying from three-fourths to seven-eighths, with marble dust or powdered lime stone being substituted for the slag used in the previous mixture and formed into blocks, slabs or other shapes are compressed and subjected to the carbonic acid gas treatment, produces a stone that can be polished the same as natural marble, and that will possess all of the weathering qualities of the natural stone.

NATIONAL BRIDGE CO., INDIANAPOLIS.

Has issued a handsome 94-page catalogue, covering bridge illustrations erected by the company under the Suten patents. Over fifty half-tone illustrations are shown all in Reinforced concrete. Over fifty cross sections and plans are given. This company has erected over 700 bridges during the past seven years. In many of the Suten bridges the bed of the stream is paved from abutment to abutment to prevent the undermining of piers and abutments.

INCORPORATED.

The Ohio Cement Vant company, of Findlay, Ohio, capital \$50,000, was incorporated today by W. J. Boyer, Anne E. Boyer, Joseph Poley, Rosa Poley and Elmer S. Loose.

A committee of the American Street and Interurban Railway Engineering association is sending out a circular letter with the request that all railroads which have been experimenting with concrete ties give the committee information regarding the design of the ties, cost, results of service, etc.

A syndicate has purchased 400 acres of land from Mrs. J. B. Kamegay, located near Demopolis, Ala., purchase price is given at \$40,000. A cement plant is to be built on the land by the following interested parties. B. F. A. Saylor of Rome, Ga.; J. D. Riggs of Selma, Ala.; O. H. Sample, and J. L. Means of Shreveport, La., and James Bradshaw of New Orleans.

The Missouri Portland Cement Co. has been incorporated, capital stock \$1,000,000, head office 112 Edmond st., St. Joseph, Mo. T. J. Benkendorf, Pres.; H. W. McNutt, Sec. and Treas., all of St. Joseph, Mo., the capacity of the plant is to be 1,000 barrels per day.

The George E. Nicholson Syndicate has about perfected arrangements to erect a cement plant at Des Moines, Iowa, as a branch of the Iowa Portland Cement Company, now erecting a mill at Mason City, Iowa. The company will open offices in the Flynn Block, Des Moines, The Hunt Engineering Co., will have charge of the construction.

The City of Los Angeles, Cal., will construct a Portland Cement Plant for the purpose of manufacturing cement to be used in building the Owens River aqueduct. In the meantime something over 1,280,000 bbls. will be used in this work. A cement expert is now at work on the data for the plant. In the meantime 30,000 barrels will be purchased to make a start on the aqueduct which will be used to furnish the city with its water supply.

International Portland Cement Co., of Hull, Canada, by a vote of its share holders will increase its

capacity to 3,000 barrels per day by an increase of its capital stock from \$1,000,000 to \$1,250,000. The stock for the additional capital will be allotted to the present stock holders at par. in proportion to their present holdings the company has done a prosperous business under the management of Mr. J. S. Irvin, due to the high grade cement produced for which orders far in excess of the present capacity of the plant have been received.

A cement project is developing at St. Paul, Minn., an extensive deposit of marl located on the Walab farm owned by John McElroy of St. Cloud, being the objective point. The project depends upon the degree of interest taken by local parties in the proposed plant.

Three Cement Plants have been projected at or near El Palso, Tex., two of these plants will be on the American side of the river and the other in Mexico.

The Kaw Portland Cement Co. is being organized at Fort Scott, Kansas, ground has been selected for the plant 2 miles southwest of Fort Scott, on Rock Creek, the capital is to be \$3,000,000 of which \$1,000,000 will be preferred stock and \$2,000,000 common. The capacity will be 2,500 barrels per day. A West Virginian Charter has been obtained.

The officers of the Company are as follows.

C. C. Nelson, Pres.; D. P. Thomas, Vice Pres., and Gen. Manager, Grant Hornday, Treas., and C. E. Hulett, Secretary, all of Fort Scott.

The following parties are interested in the enterprise.

H. C. Ward, National Bank of Commerce, Kansas City, Mo.; Ira G. Hedrick, R. A. Barr, Wm. Huddick, A. M. Gloyd and C. C. English all of Kansas City, S. A. Wright, Nevada, Mo.

The City of Winnipeg, made a great showing in building construction last year. With a population of 100,000 Winnipeg invested \$12,760,450 in new buildings. This is more than was spent in Building Construction in Minneapolis, St. Paul, and Denver combined. The city is growing at a rapid rate.

The Wathena Portland Cement Co., of Wathena, Kan., has been organized, capital \$200,000. The officers of the company are:

F. H. Drosselmeier, Pres., Jacob

Miller, Vice Pres.; A. W. Thoman-son, Sec. The company has purchased about 125 acres of land conveying lime stone and shale on Peters Creek, about 5 miles west of St. Joseph, Mo., in Doniphan County, Kansas.

A company is being organized at Tulsa, District 8, Indian Territory to be known as the Tulsa Portland Cement Co., Incorporation papers have been filed at McAlester, I. T., the capital stock is fixed at \$2,500,000. The plant is to be located at West Tulsa, otherwise known as Lost City.

A company located at Battle Creek, Mich., has been formed to manufacture concrete columns and tomb stones after patents secured by Ernest Wood.

Hudson River Concrete Co., Brooklyn—Real estate, contracting; Cap., 25,000. Incorporators: J. D. Balcomo, R. G. Balcomo, J. M. A. Cook, Brooklyn, N. Y.

The Iola Portland Cement Co. has a new gas well three and one-half miles northwest of Iola, on the Horville farm. It is pronounced one of the best wells in the Iola field. It will yield at least fifteen million cubic feet daily.

Portland cement is selling at Portland, Oregon, at \$3.25 per barrel and is a scarce article. This is from 75 cents to a dollar higher than last year's prices. Most of the cement comes from Hamburg in vessels carrying wheat on their outward bound voyages.

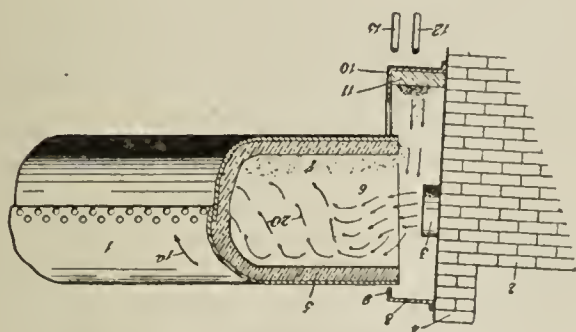
A FIRE AT THE CRESCENT CEMENT WORKERS.

A fire at the Crescent Cement works, Sonque Point, Quebec, on April 30th, destroying the engine room, machine shop and blacksmith shop. A new plant has been under construction for some time and will be occupied by June 1st, this new structure was not injured, the old mill will be abandoned.

The various additions to the plant of the Belleville Portland Cement Co., Ltd., Belleville, Ont., Canada, are rapidly nearing completion, which will increase the output to a 2,000 bbl. basis. Mr. Lucius E. Allen who has been with the Company in the capacity of Chief Chemist has been appointed to the position of Superintendent and Chief Chemist. Mr. Allen was formerly connected with the New Castle Portland Cement Co., of New Castle, Pa.

U. S. PATENTS RELATING TO
CEMENT AND CONCRETE.

851,765, Cement-Kiln. Thomas M. Morgan, Longue Pointe, Quebec, Canada. Filed Mar. 1, 1906. Serial No. 303,582.



No. 1.

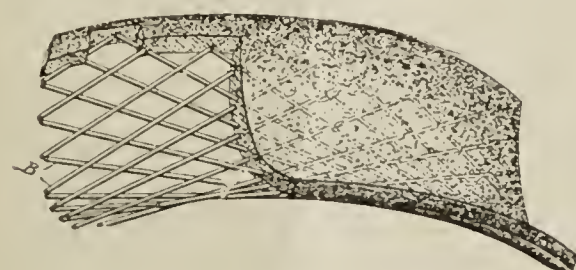
Claim.—1. In a device of the class described, means for discharging a quantity of pre-heated air into the kiln, and means for imparting to said air a swirling or revolving motion.

2. In a device of the class described, means for passing a quantity of air over the cement as it is discharged from the kiln, means for imparting a swirling or revolving motion to said air as it enters the kiln, and means for preventing the access of cold air at the mouth of the kiln.

3. In a device of the class described, means for passing a quantity of air over the cement as it is discharged from the kiln, means for thoroughly mixing with said air with the flame of combustion, and means for preventing the access of cold air into the kiln and for imparting to the flame of combustion a circumferentially revolving motion.

7. In a cement kiln, means for discharging a stream of inflammable material into the kiln, a circumferential baffle plate located at the mouth of the kiln, an inclined passage upon which the cement is discharged from the kiln, a pipe for discharging a quantity of steam or air over said cement and against said baffle plate whereby the air will enter the kiln with a swirling or revolving motion to be thoroughly mixed with the inflammable material.

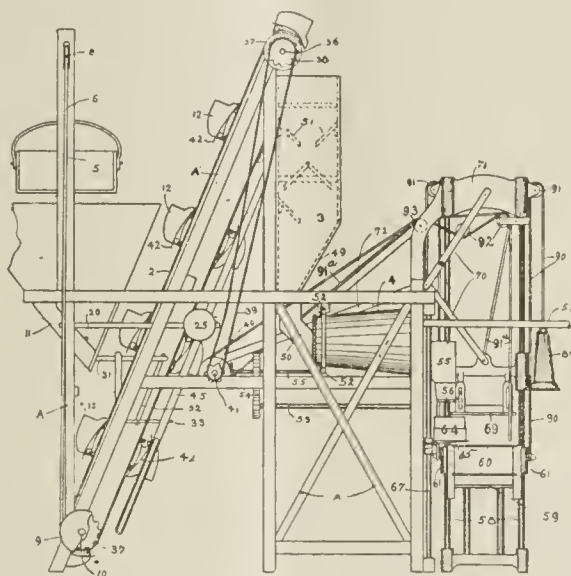
852,202. Reinforced Concrete Arch. Henry M. Russell, Jr., Wheeling, W. Va. Filed Mar. 23, 1906. Serial No. 307,610.



No. 2.

5. A reinforced concrete arch comprising a concrete body having a cross section of an inverted arch shape, metallic reinforcing members embedded in the said concrete body, the said reinforcing members being straight, and sundry of the reinforcing members extending from one side to the other, and sundry of the said members extending from the sides to the abutment ends, the reinforcing members crossing each other to form a net work.

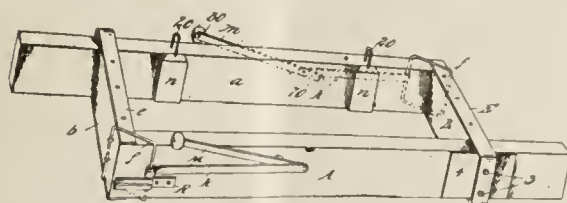
852,579. Block-Making Plant. Herbert G. Rounds, Bay City, Mich. Filed July 11, 1906. Serial No. 325,739.



No. 3.

4. A block molding plant comprising a bucket conveyer, trips carried by each bucket, a chute terminating adjacent the conveyer, gates in the chute, lever mechanisms connected to the gates, one of the chutes being adjustable relative to the other, trip levers connected to the respective lever mechanisms and lying in the normal path of movement of the trips on the buckets have not received a full charge, mixing devices into which the material is discharged from the conveyer, a mold form for receiving the material after mixing and pressing mechanism actuated by the conveyer for compressing the material in the mold form.

852,892. Mold for Making Building Blocks. Donald M. McCall, Jackson, Mich. Filed May 31, 1906. Serial No. 319,424.

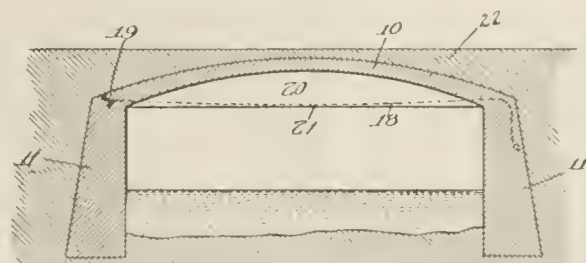


No. 4.

Claim.—1. In a mold for building blocks, in combination with side members and end members assem-

bled in pairs, the members of each pair being in sliding connection, clasps adapted to engage over the meeting corners of two bars to secure the same together and means for locking and for thereafter releasing said clasps from engagement over said corners, substantially as described.

853,204. Arch Structure. Daniel B. Luten, Indianapolis, Ind. Original application filed May 17, 1902, Serial No. 107,812. Divided and application filed July 25, 1904, Serial No. 217,936. Divided and this application filed Oct. 4, 1905. Serial No. 218,336.



No. 5.

Claim.—1. A series of concrete girders joined by a curved floor.

2. A series of concrete girders joined by a floor curved longitudinally with the girders.

3. A curved compression member of concrete or similar material with metal tension chord embedded in a depending rib.

4. A reinforced concrete girder limited above by a curved drum with its axis transverse to the girder.

5. An arch of concrete with ties from abutment to abutment at or above the springing, and embedded in ribs of concrete.

6. An arch of concrete with ties from abutment to abutment near the springing and embedded in ribs of concrete.

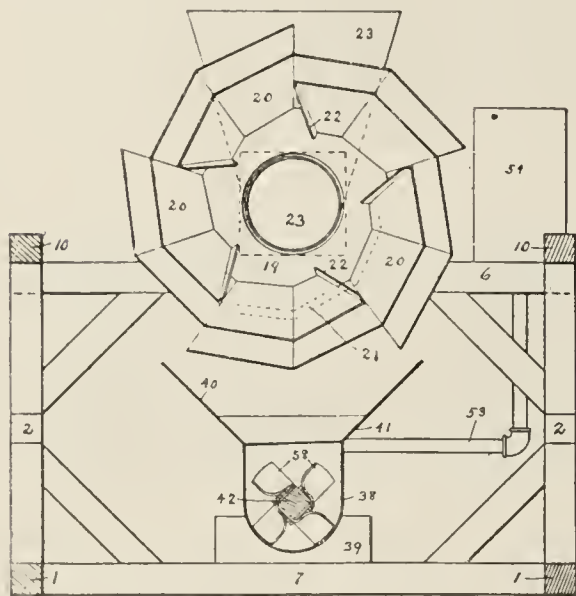
7. An arch provided with depending internal ribs and suspension rods sagged at the middle embedded in said ribs, substantially as described.

853,623. Concrete-Mixer. Frank A. Borst, South Bend, Ind., assignor to Ideal Concrete Machinery Company, South Bend, Ind., a corporation of Indiana. Filed Dec. 28, 1906. Serial No. 349,798.

Claim.—1. In a mixing machine, the combination of heads, means to revolvably support the same, spiral buckets connecting said heads and provided with interior flanges at their inner ends, the buckets being formed of pairs of flat plates and joined at the central plane of the mixing machine so as to form pyra-

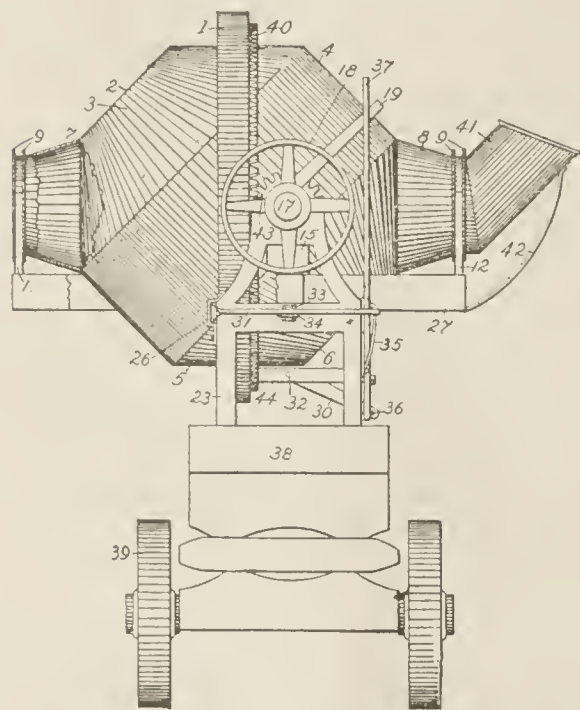
midal parts united at their bases, and means to support the mixer.

2. In a mixing machine, the combination of heads, means to revolve the same, spiral buckets connecting said heads and provided with interior flanges at their inner ends, the buckets being in halves joined at the central plane of the mixing machine so as to form pyramidal parts united at their bases, and means to support the mixer.



No. 6.

853,945. Concrete-Mixer. Charles L. Baldwin, Waterloo, Iowa. Filed Jan. 15, 1906. Serial No. 296,034.



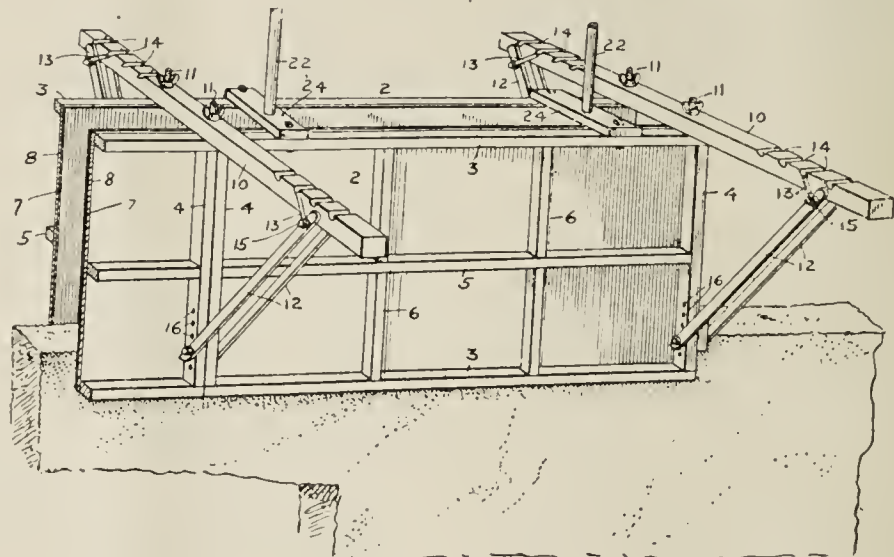
No. 7.

4. In a concrete mixer, the combination of revoluble mixing drum, comprising a hollow cylinder having closed truncated conical ends, the axis of said drum being inclined to the axis of rotation, an inlet spout and an outlet spout connected to opposite ends of said drum in the axis of rotation, a tilting frame rotatably supporting said drum, trunnions on the tilting frame outside the center of gravity of said tilting frame outside the center of gravity of said tilting frame and mixing

drum, means for holding the tilting frame in operative position, and means for rotating said drum.

854,098. Concrete-Wall Form. Oscar F. Mann, Indianapolis, Ind., assignor to Henrietta Mann, Indianapolis, Ind. Filed July 12, 1906. Serial No. 325,849.

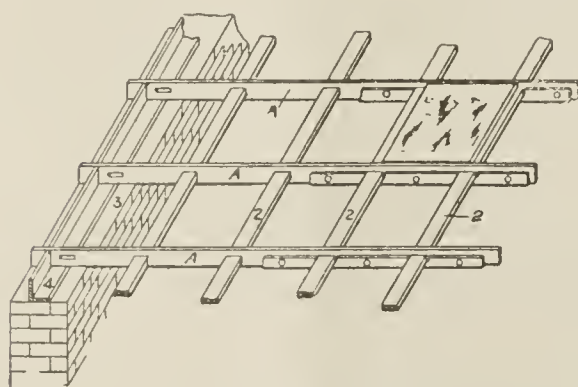
8. In a form for concrete walls, a pair of sides between which the wall is formed, transverse beams above said sides said beams having trans-



No. 8.

verse notches in their upper sides, diagonal braces secured at their lower ends to the lower portions of the sides, clevises placed astride of and relating in notches of the beams and having their depending ends bolted to the diagonal brace bars and wedges driven between the bottom of the beam and the bolt which connects the clevis with the diagonal brace bars the above structure being raised by the frictional contact of the said sides with the newly formed wall.

854,502. Floor, Sidewalk, Roof, and Like Support. Peter H. Jackson, San Francisco, Cal. Filed Nov. 23, 1905. Serial No. 288,823.



No. 9.

Claim.—In a structure of the character described, flat single metal bars standing on edge having longitudinal slots intermediate of the top and bottom edges, and at substantially equal intervals between each other and the ends, flat bars

slidable through said slots, a wall or arch above which the ends of said edge bars project, angle iron bars having one member lying upon the wall, said bars having their up-turned flanges vertically slotted substantially to the surface of the flat portion, and at intervals coinciding with the spaces between the first named edge bars, and farming therewith means for spacing and adjusting said bars to receive equal sized

tiles and a surrounding cement filling.

THE GERMAN CEMENT INDUSTRY IN 1906.

The past year was favorable for the German cement industry. Thirty of the largest plants representing a capital of \$22,000,000, declared from 10 to 11 per cent dividends. This in the face of heavy imports of cement into Germany amounting in 1906 to 221,449 tons, mostly from Belgium into West Prussia. The Rhenish Westphalian Cement Syndicate at once established sales offices at Cleves, where prices were reduced to meet the Belgian competition which was in a measure successful. The mills were working on large orders for San Francisco and Valparaiso.

EARTHQUAKES AND EARTH-QUAKE-PROOF BUILDINGS.

By William F. Scott.

A match will start a game that will light a cigar. This same flame will light a city into an unquenchable blaze if the conditions of fuel and air supply are favorable and the provisions for fire protection unfavorable.

In the recent San Francisco catastrophe we have a case where the fuel was the wooden buildings and the air supply that ever present draught through the Golden Gate. The earthquake supplied the match and incidentally destroyed the

water supply for fire protection, which under the most favorable conditions was not of the best on account of the steep hills throughout the city. This great western port of the United States was a wooden city, the exceptions where wood did not prevail consisting of a comparatively small percentage of buildings in the business section. The "Native Son" always gave as a reason for this fact that buildings of wood were safe against earthquake shocks and because of the non-combustibility of the California redwood were insured against a great conflagration.

That their faith in wood has been "shaken" and will be transferred to steel or steel concrete is the lesson written in the ashes of this catastrophe. The fire swept over an area of about seven square miles and of the buildings in this burned district the modern steel frame structure stood out in grand contrast to all other types. They even stood the test better than might be expected because few of them were built in any way different from the conventional Chicago-New York Steel Skeleton which was designed to resist static loads and wind pressure only, and in which such strains as would be caused by an earthquake tremor were not considered. The cumulative resistance in the joints of these steel frames was undoubtedly a great factor in helping them to withstand the recent earthquake shocks, but to make this function positive the joints should be specially designed for the forces they must resist. Certainly reinforcement of this sort would add greatly to the power of the building to retain its enclosing materials from displacement.

That the steel frames stood the test is more than can be said of their covering or rather of the methods of binding the enclosing materials to their skeleton. The manner in which the brickwork between the steel framing of the tower of the magnificent City Hall fell in ruins about it is a good illustration of a vital point in the design of the conventional skeleton construction when applied to buildings that are to resist the strains of an earthquake shock. This tower was built on a steel skeleton frame well braced in the circumferential framing, but not provided with steel bracing in the vertical radial planes. The walls of the main building and colonade which formed the architectural base of the tower were of ordinary masonry construction and served the purpose of bracing the steel in the radial planes, thus when

these walls were disturbed by the earthquake shock the tower was free to oscillate, which in turn caused the displacement of the spandrel filling between the steel framing.

The tremors of an earthquake pass over the face of the globe as waves in the fluid earth. They are more complicated than the waves of the ocean but their effect upon a building is analogous to that produced upon a boat at sea. There is a vertical and a horizontal force in the motions of these waves, therefore, if a building is to safely ride them it should be built with the same continuity and rigidity of frame as is obtained in the great ocean liner of to-day which, considered structurally, may be likened to a pair of huge curved plate girders braced transversely with trusses and gusset portals. The ideal earthquake-proof building, then, should be, figuratively speaking, an ocean liner on end with the stern supported on a sufficient base of concrete and with the windows built in the same manner as are the port holes of the ship. But the architect is not permitted to make such radical departures from the conventional types of buildings. He must have square windows and pierce one-third his walls upon which he must write the alphabet of historic architecture. The ideal, therefore, is impossible, but a compromise between the ideal and the common type of skeleton construction is practicable.

It is beyond the scope of a short article to enter into details as to just what such a compromise would be; these details would vary with the individuality of every engineer who attacked the problem. However, I would premise three certain and fundamental requirements that must be considered in these details:

(1) There must be a rigid connection between the columns and girders of the skeleton frame, but flexibility must not be sacrificed to rigidity.

(2) There must be continuity in the foundation for the skeleton.—The writer is of the opinion that the principle of construction of the "lighter" should be kept in mind for these foundations.

(3) There must be a comprehensive method of binding the enclosing masonry with a view to making it an integral part of the skeleton.

Steel-concrete and steel were mentioned above as competitors for place in the faith of future earthquake-proof builders. The developments in this method of construction are comparatively recent chro-

nologically speaking, but there is no doubt that reinforced concrete will be an important factor in the development of these buildings. Earthquake-proof building we have said must have continuity and rigidity of frame and must stand severe shocks. The driving of reinforced concrete piles 35 or 40 feet in length without any shattering proves that the resistance of this material to shocks is very great; and as for the continuity and rigidity of this form of construction there is no more ideal method of obtaining both. It is just a question of placing sufficient reinforcing material where it will perform these functions.—The Canadian Architect and Builder.

The Lakefield Portland Cement Company with headquarters at Lakefield, Ontario, Canada, are just completing a large plant at Montreal. This company already has several plants in operation and is one of the largest producers of cement in Canada.

The plant is thoroughly modern in design and electrically equipped throughout. The plant will start with a capacity of two thousand barrels per day, with provision for increasing in the near future.

The equipment of rotary kilns, stone and clay driers, clinker coolers, ball mills, and tube mills was furnished by The Bonnot Company of Canton, Ohio.

The plant is favorably situated, and will be one of the best equipped in the Dominion.

FOR SALE.

No. 3 McKelvey (continuous) Concrete Mixer, cheap; mounted on truck with steam engine and boiler all complete; in excellent order. Address H. C. Hunsberger, 918 Royal Insurance Bldg., Chicago, Ill.

POSITION WANTED—Chemist thoroughly experienced in chemical and physical end of cement business. Address D. E. F., Care Cement & Engineering News.

POSITION WANTED.

By a first-class cast-stone maker. Known as Litholite and Roman Stone, "Stevens' Process." Competent to take charge of plant. First class references, if desired.

Address, E. N. C., Care Cement & Engineering News, Chicago, Ill.

WANTED.

Resident Engineer or Works Manager required to run an entirely new plant erected to manufacture Portland Cement from chalk and clay by wet process with rotary kilns, situated at Croydon Surrey, England. Must have previous experience in making cement by the rotary process. Competent Engineer, good labor Master and have experience of modern methods of working factory costs. Two good references as to character and qualifications. Liberal salary will be paid ranging from £300 to £500 per annum according to qualifications and experience. Residence optional. Passage out. Apply direct to Hall & Co., Croydon, Ltd., Victoria Wharf Croydon, England, or our Correspondent the Editor, "Cement," 22 Fifth avenue, Chicago, who will furnish further particulars including pamphlet of the works and arrange interview if desired.

FOR SALE.

State or county license of a cheap process of making high grade granite imitation for building and ornamental work, fire and damp proof, magnesium floor and insulating work; colored inlaid cement floor and pavement tile. Address Julius Ruoff, care Cement and Engineering News.

Cement Plant Superintendent, technical graduate, having had twelve years experience as superintendent of cement plants, desires position. State particulars, location, etc. Address P. C., Cement & Engineering News.

Cement Chemist with five years' extensive experience as chief chemist desires change of location. Familiar with wet and dry processes. References from past and present employers. Address M. M. B., care Cement & Engineering News.

FOR SALE

On account of re-arrangement of our grinding department, we offer for sale $\frac{3}{4}$ 'x16' Smidth Tube Mill Shells with Silex lining. All in A1 condition. Alma Cement Co., Wellston O.

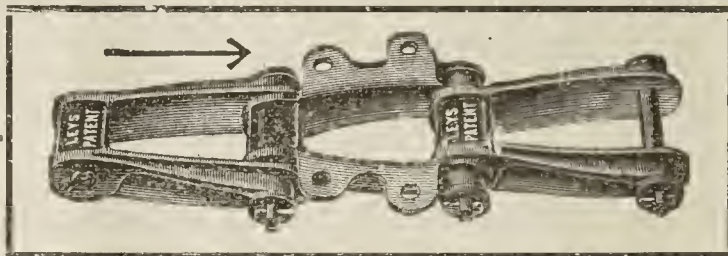
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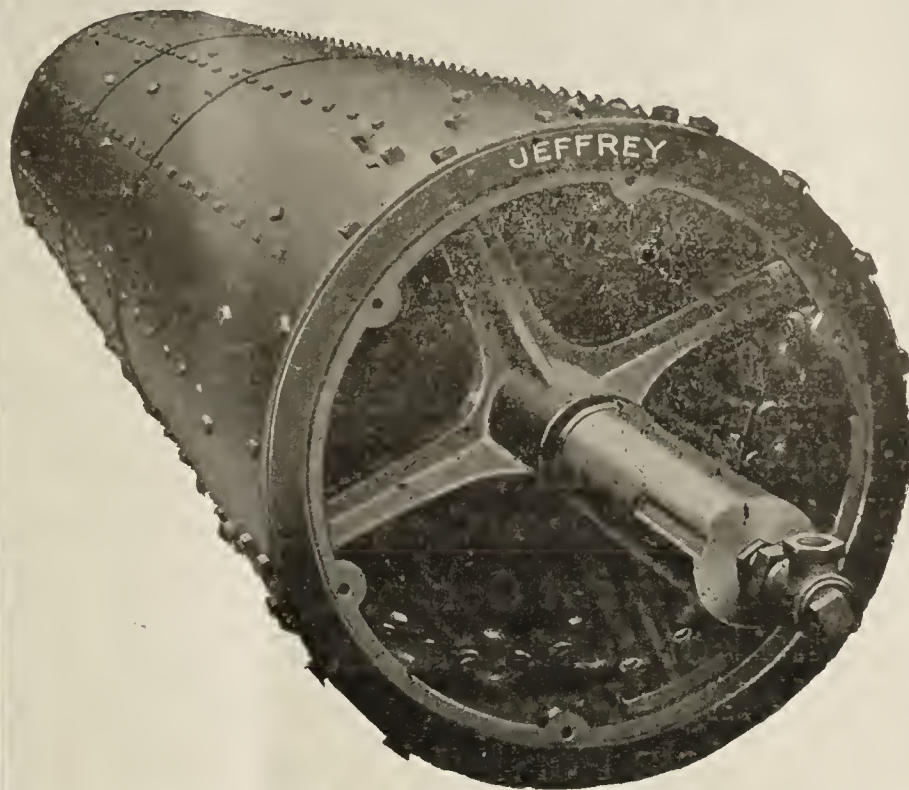
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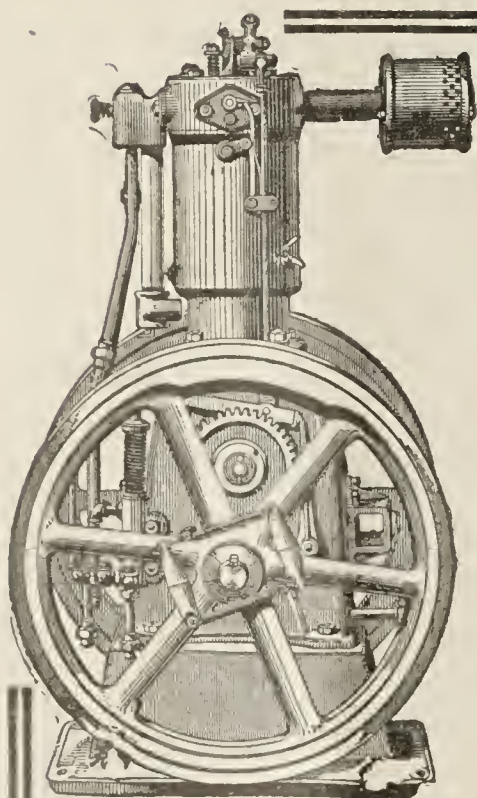
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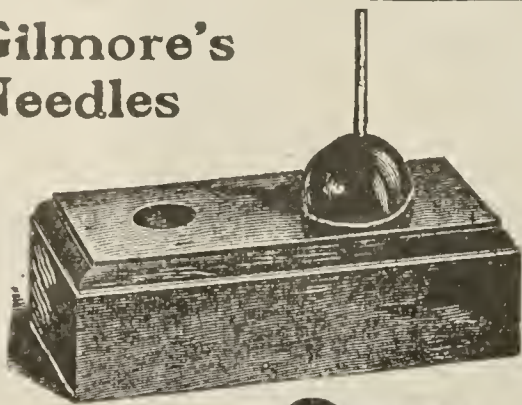
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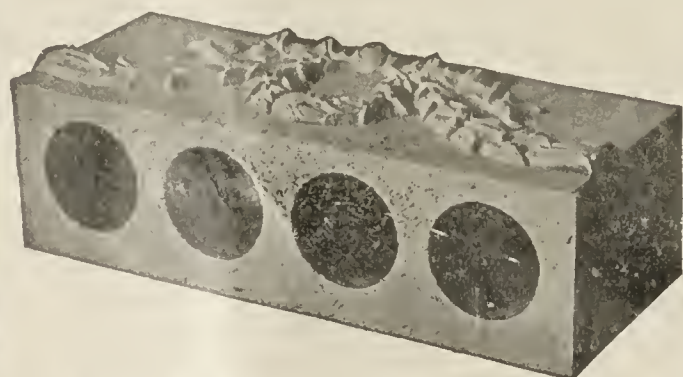
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(PUBLISHED MONTHLY)

WILLIAM SEAFERT, Editor and Publisher

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CONCRETE BUILDING BLOCK MACHINERY.

The rapid strides made by the concrete building industry during the past few years, has resulted in placing upon the market any amount of machinery for their production. Much of this machinery is bad in design as well as complicated, the main object being to produce something cheap, and at the same time avoid infringing upon the claims of previous inventors, with just sufficient change in the design to pass muster at the patent office. While others have gone in and copied existing styles flat footed, often sacrificing the most essential points which a practical machine must possess, to do good clean work. Success in the designing and building of this class of work comes from experience alone. There is scarcely a successful machine upon the market that has not gone through regular stage of development to overcome defects, which appear from time to time under the various conditions encountered in actual construction work. The intending purchaser should look beyond the broad claims made in circulars and advertisements, and examine closely into the record of the machinery which lies back and beyond all advertising matter, and look for results that have been accomplished in the hands of the block manufacturers who have built up, and made

a success of the building block industry; because the good, bad and indifferent machines all make the same claims in the advertising columns of cement journals. The novice who desires to engage in the cement block industry will find the new and untried machinery advertised on the same page with the sound, reliable and practical block machines. The one pays his advertising bills promptly, the other is carried a dead head. This is an injustice to the purchaser as well as to the reliable manufacturer who pays as he goes, and delivers, sound and reliable equipments that have stood the test of time, and therefore will give satisfaction to the cement block maker, new and old. The purchaser who is looking for a "snap," and who wants something for nothing is only looking for trouble when he jumps at the "snap" which will land him in a hole. Our advice is to pay a fair price for your outfit, and deal with manufacturers of established reputation. Purchasers, new in the business should let others do the experimenting with new machinery and it will be money in their pockets in the end.

A FALSE REPORT.

The Chicago papers published a statement to the effect that the three Portland cement companies whose works are located at and in the vicinity of La Salle, Illinois, had combined under a single head. The companies being the Chicago Portland Cement Co., the Marquette Cement Co., and the German American Portland Cement Co. Each of these companies maintain offices in Chicago. The statement is entirely without foundation.

THE CEMENT TRUST.

The frequent mention of a cement trust by the daily press has lead many fair-minded people to believe in the actual existence of such an organization in this country. There is no cement trust and can be none that can control the manufacture of Portland cement or regulate prices of the finished product. The raw materials from which Portland cement is made, "lime stone and clay," is so widely distributed throughout this country that these materials can never be controlled by any single or-

ganization however vast its resources. It is the only raw material used in building construction that is practically inexhaustible. This can be said of no other material used in the arts. The process of manufacturing Portland cement is so well known that competent engineers can be engaged to erect new plants without any restraint by any existing authority, so that new capital and brains may embark in its manufacture without let or hindrance, as is the case today in the many new cement plants under construction. The cement trust is a myth. Without form or substance.

PRODUCING POLISHED EFFECTS ON CONCRETE WORK.

Concrete slabs and brick are now being produced in Europe, that are as fine in grain and structure as high grade porcelain, showing an equally fine polish. The secret of the progress consists in grinding the aggregates to as fine a powder as the cement. The mixture one cement to as high as twelve of aggregate is then dampened just sufficient to pack well when pressed in the hand. It is then subjected to high pressure in strong iron molds, up to 5,000 pounds per square inch. The best results are obtained in slabs or plates slightly under one inch thick. The pressure is applied in four or more strokes. After each stroke the pressure plate is removed to permit the air to escape. After each stroke the pressure is increased. The object of grinding the aggregates to the same fineness as the cement is to prevent forming an arch in the stone, which always takes place where high pressure and coarse aggregates are employed. Then again if the pressure applied to the concrete exceeds the crushing strength of the aggregates, the aggregates will grind at the contact point in the mass, leaving powdered contact points which weakens the concrete. This defect is entirely overcome by using a fine powdered aggregate. It will be seen that high pressure and coarse aggregates are inconsistent for fine work. Coarse aggregates can, however, be used where the mold produces forms in the shape of an arch, and the pressure applied is below the crushing strength of the aggregates. It is extremely bad practice to use high pressure in molding concrete blocks over 4 inches high on account of the danger of the arching of the aggregates. Tamping square or hollow concrete blocks is always to be preferred for sound work.

CONCRETE RAILWAY TIES.

The tie problem is probably the most serious and perplexing question with which the railroads have to contend. Tie requirements for the railroads of the United States are increasing yearly in the face of an ever decreasing supply of timber. The tremendous growth of electric railways in the last few years has created a new factor in the tie problem and if they continue to grow, as seems likely, they will soon require almost as many ties annually as the steam railways.

The limited and rapidly decreasing supply of timber has caused timber ties to become poor in quality and high in price. As an example of the seriousness of this great question, one large Eastern railroad has planted since 1902 approximately 480,000 yellow locust trees, with a view ultimately of obtaining a partial supply of tie timber, and it is the intention of this railroad to plant 800,000 additional trees.

Many of the railroads are beginning to inquire concerning the use of concrete ties, but this class of ties has been giving such different results on the railroads where they have been tested that comparatively little definite general information regarding them is available. Some railroad men consider them failures; others regard them as promising substitutes for wood, while in some instances they appear to have proved entirely practicable. An investigation of their service records shows two rather general conditions; the first is the tendency of the concrete to break away from the reinforcement when much steel is used, and the second is the trouble in keeping the fastenings in the ties. Both these conditions might have been anticipated by those well acquainted with concrete and certainly are preventable. This article has been prepared from items culled from cement journals and also from the answers to a circular letter sent out by this Association to a number of railroads asking for information on the subject.

Mr. G. H. Kimball, Chief Engineer of the Chicago and Alton railroad, who has devised what he regards as a thoroughly practicable tie, is the author of an article on Concrete Ties, which was published in the April, 1906, edition of the Cement Age, from which we make the following abstract:

"There have been many fitful attempts to make a satisfactory concrete tie. The idea that concrete will not stand the shock of impact under heavy and high speed trains is erroneous, for blocks of concrete, even without steel, when properly

designed and arranged are capable of supporting the heaviest traffic. The French roads in Indo-China have been using concrete for some years and to a large extent. The writer's attempt to solve the problem began some years ago and the subject has been pursued as closely as possible ever since. The design adopted and here described was completed and first put in track in November, 1901. It consists of two blocks of concrete make one tie and long, placed symmetrically under each rail so that the center of pressure and the center of figure of each section will coincide. These two blocks of concrete make one tie and are rigidly connected by being molded on the ends of a pair of three-inch channels weighing three pounds per foot. The channels are back to back and spaced two inches apart in the clear. The concrete blocks are seven inches thick and nine inches face, and the cross section is the same as that of a timber tie hewn or slabbed from a log about eleven inches in diameter. It presents the appearance in the track of an ordinary tie with a piece of 2 ft. 11 in. long cut out of the center. Hardwood blocks three inches thick, nine inches wide and eighteen inches long, designed to cushion shocks, distribute pressure, support derailed trucks and serve as spiking blocks, are secured to the top of the concrete blocks. Each hardwood block is, of course, centered transversely to the line of the rail. Cast iron sockets that also serve to space and connect the channels are molded in place in the concrete, serve as an anchorage for holding down the hardwood blocks. These sockets receive suitable bolts, head down, so that when they are slipped to place and the holes through which they are introduced have been plugged they cannot be withdrawn. The first ties put in have been in service over four years and small lots have been put in from time to time since. The last were put in the track of the C. & A. Ry. in October, 1905. Of all the ties put in from the first to the last none have failed. Three and one-half years ago 1700 of these ties were put in the track of the Pere Marquette Railroad in Bay City, Michigan. The ties were put down on a concrete bed and each tie was set to the grade, being imbedded in a joint of cement mortar. The rails were then spiked down and the track filled in. I am informed by those in charge that there has been no change in the line, gauge or surface of the track. The fact that concrete will stand in this form and under these conditions cannot be questioned. It is not too much to

claim that this affords a solution for the tie problem at a moderate cost, and offers large economies in wear of rail, ballast and in track labor."

Mr. Samuel Rockwell, Chief Engineer of the Lake Shore and Michigan Southern Ry., says that his road is using a tie designed by Mr. C. Buhner, one of his road-masters. He states that a number of these ties have been in slow track three or four years and will undoubtedly be there a great many years to come. Some were placed in fast track, which, however, pounded to pieces and Mr. Rockwell believes that they are not suitable for tracks which carry a very heavy traffic at fast speed. On the other hand, he states that this should by no means condemn them for yard tracks, or any other tracks which carry their traffic, however heavy it may be, at a slow speed. "Concrete ties have a great field on such tracks wherever wooden ties, on account of sharp curvature, or any other reason, fail to maintain gauge, cut out rapidly, or are otherwise objectionable." Over 5,000 of these ties have been made, and 4,200 are in use, as follows:

Lake Shore & Michigan Southern Ry. (Elkhart Div., 1,000; Old Road, 1,003; Sandusky Div., 710; Chicago Div., 230)	2,943
Pennsylvania Lines	450
Lakeside and Marblehead Ry.	550
Sandusky City Waterworks track	120
Ann Arbor Ry.	77
Lake Erie and Western Ry. .	24
Wabash Ry.	25
Chicago & Northwestern Ry.	15
Total	4,204

Mr. A. S. Baldwin, Chief Engineer of the Illinois Central Railroad, says: "I find that out of some twenty different types of concrete ties which have been submitted to the Illinois Central Railroad, three were thought to show sufficient merit to warrant a service test. Of these three styles one was of the reinforced type. None has given entire satisfaction. Over fifty per cent. of the ties have been found to be cracked and broken, owing to the fact that it is found to be impossible to maintain an even bearing for the lower surface of the tie throughout its entire length, and any unevenness of bearing results in the tie breaking or cracking. It is quite possible that a concrete tie may be designed which will be economical and give good results, one which will permit of easy removal of the rails in case of breakage or renewals, and one which will withstand as successfully

as a wooden tie the destructive action of derailed car wheels, but those tested by the Illinois Central R. R. cannot be said to have fulfilled these requirements. Methods of fastening tie to rail have not been considered satisfactory in the types so far submitted to us, and no arrangement was made in any of them to prevent the rail creeping. The only point that we have found, so far, to be wholly in favor of concrete, is that at points where engine fires are drawn or cleaned, they do withstand the action of the fire indefinitely, while a wooden tie would be destroyed in a few months."

Mr. Arthur Montzheimer, Chief Engineer of the Elgin, Joliet and Eastern Railroad, says: "This railroad has been experimenting with a concrete tie invented by Mr. R. B. Campbell, General Manager of the E., J. & E. Ry. The first ties were made in 1904. They were put in one of the main switching leads at Joliet and they are giving very good service. During the past year (1905) one thousand concrete ties were made after a slightly improved plan. Practically the only changes made in the 1905 ties over the 1904 ties was the substitution of a larger plate under the rail." The following description of the Campbell Concrete Tie appeared in *The Railway and Engineering Review*: "The main body of the tie is rectangular in cross section, 7 ins. wide and 6 ins. deep, with beveled corners, top and bottom. Under the rails the tie is enlarged to a width of 10 in. The length of the tie is 8½ ft. The reinforcement consists of two scrap boiler flues of 2¼ ins. outside diameter, and 7 ft. long, laid side by side and staggered so that their ends overlap 7½ ins. An additional reinforcement of common chicken wire netting is placed around the tubes, and a piece of heavy wire netting 6x8 ins. is inserted in slots in the tubes, directly underneath the rail seats. The bearing for the rails consist of tie plates, and the fastenings consist of U-bolts which pass through the tie plate and screw down upon clips which hold the rails in place. The cost of manufacturing this tie in quantities is estimated at \$1.50 to \$1.75 each. On September 7, 1904, sixty-five of these ties were placed in one of the main switching leads of the E., J. & R. Ry., where they have been subjected to the heaviest service possible, and no failure or deterioration has been observed. They have maintained the track in good surface and line, and apparently the frost has not affected them in the least."

The Galveston, Houston and Henderson R. R. has been experimenting with the Percival Reinforced

Concrete Tie. The dimensions of the tie are 8 ft. in length, 9¼ in. face, and 9 in. depth. Under the rail is a 2 x 9 x 14 in. wood cushion, which is made in such shape as to readily give to the weights as they strike the rails. In fastening the rail to the tie, use is made of a screw spike 10 in. long and ⅞ in. in diameter. This spike passes through the wood cushion, and screws down into a socket in the tie filled with a composition of galvanized steel and bab-bit.

The concrete tie appears to possess certain advantages over the steel tie. In the first place, it has a greater bulk and weight, and there is no difficulty in obtaining sufficient weight for stability without reaching too high a cost. In the second place, the manufacture is much simpler and requires less expensive plant, even for manufacture on commercial basis. There is also less dependence upon market conditions than is the case with the steel tie. The use of concrete ties is therefore an interesting experiment to the railroads in this country.

In this connection it is rather interesting to learn that a Committee of the American Street and Interurban Railway Engineering Association is sending out a circular letter with request that all railroads which have been experimenting with concrete ties give the committee information regarding the design of the ties, results of service, etc.

This article has only touched the surface of a very broad subject, but we believe it is sufficient to show what has been done, and if it has suggested any points that will serve as a basis for discussion and investigation, it will have fully served its purpose.

CITY SPECIFICATIONS FOR CONCRETE BLOCKS.

(Extract from Bulletin No. 1, of the Association of American Portland Cement Manufacturers.)

In order to guard against the use of blocks of poor quality and to insure safe construction of block buildings, a number of cities have adopted specifications for the acceptance and use of building blocks of concrete. The building regulations of New York City in regard to all materials used as substitutes for brick or stone are extremely severe, requiring tests to be made on blocks the size and shape of an ordinary brick, which must show an average modulus of rupture of 450 lbs. in transverse test, average compression

strength of 3,000 lbs., water absorption not over 15 per cent., loss of not more than 33 per cent. strength after freezing and thawing 20 times, and no disintegration after heating 1 hour to 1,700 degrees F. and plunging into cold water.

The City of Philadelphia for a time followed these requirements, but has lately modified them and provides that tests of hollow concrete blocks shall be made on full-sized specimens. The most important requirements are:

Blocks to be made of Portland cement with not more than 5 parts sand and gravel or crushed rock; hollow space to be not over 33 per cent. (20 and 25 per cent. in lower part of high walls); maximum load 111 lbs. per square inch of wall; crushing strength 1,000 lbs. per square inch of total surface of block including openings; absorption, freezing and fire tests as in New York requirements.

Concrete blocks in the Philadelphia market have shown compression strength of 1,200 to 1,600 lbs., absorption of about 5 per cent., little loss of strength on freezing, and have passed the fire test well.

The City of Newark, N. J., requires that blocks shall be not poorer than 1 to 4; they must be no more than 36 inches long and 10 inches high, and not less than 8 nor more than 16 inches wide; the hollow spaces must not exceed one-third; they must not be used until 30 days old; and must show a crushing strength of 1,500 lbs. per square inch.

These various city requirements seem generally reasonable and certainly severe. It is difficult to see, however, why the hollow spaces should be limited to one-third or less, when strength is fully provided for by a compression requirement of 1,000 lbs. on the whole area of the block. If blocks with thinner walls will show this strength, there appears to be no ground for prohibiting them.

THE FUTURE OF CONCRETE.

In speaking of this subject Mr. G. C. Nimmons an architect of Chicago says: "One of the strongest influences toward the increase of the number of concrete buildings nowadays comes from fire insurance companies. The Factory Mutual insurance companies of New England are strong advocates of reinforced concrete buildings for commercial and manufacturing purposes. Not so much for any superior fire-proof qualities of reinforced concrete, but on account of the superior water-proof qualities of concrete buildings.

I believe it is a matter of record that the Factory Mutuals of New England have paid more for water damage than for the fire damage. Another condition favorable to the increase of concrete buildings is the increasing scarcity of yellow pine from the southern states. The price of mill building has increased so much in recent years that the cost of a first-class mill-constructed building is almost as high as the cost of a concrete structure. Comparative bids recently taken in some instances show only a difference of 5 per cent. greater cost for the concrete over mill construction, and in other cases 10 per cent., so it is probable that the average difference in cost for a first-class mercantile building is somewhere between 5 and 10 per cent."

The Portland cement plant to be located at Harvey, Iowa, has been incorporated under the name of The Hawkeye Portland Cement Co., authorized capital \$2,800,000, of which \$1,200,000 is preferred stock, and \$1,600,000 common. With offices at Des Moines and Kansas City. The directors are Judge S. F. Proity and T. F. Flynn of Des Moines; Wm. Hutting, F. E. Wear and W. Murlin, Kansas City; J. P. Hinton, Hannibal, Mo.; Harry M. Rubey, Macon, Mo.; Wm. Fetzer, Middletown, Ohio; Winfield Smouse, Washington, Ia.; E. H. Ryan, Davenport, Ia.; I. T. Hamilton, Cedar Rapids, Ia. The officers are: President, F. E. Wear; Vice Pres., W. E. Murlin; Treas., Harry M. Rubey; Sec., Arthur L. Murphy; Consul, N. J. Guernsey, Des Moines; Engineer, D. Bontecou, Kansas City.

JUDGMENT AGAINST TRADE UNIONS.

The Ontario High Court of Justice confirmed a judgment against Local Union No. 30, Amalgamated Sheet Metal Workers, in an action for conspiracy, against the Metallic Roofing Co., of Canada. The company employed 10 workmen, 8 union and 2 non-union in the cornice department, the wages and hours for both were the same. The union men presented a form of agreement, the terms of which would have obligated the company to employ only union men. This the company refused to sign, whereupon the union men in its employ were called out in the middle of the day. The company was next placed upon the un-

fair list. Circulars were sent broadcast over the country informing the company's customers and others, that the Roofing Company dealt in unfair goods and that their goods would not be handled by organized labor. Chancellor Boyd in delivering the opinion of the Court said: the withdrawal of the men in the middle of their work, was oppressive and unfair to the company and not justifiable by any prospect of pecuniary advantages to the union men. Thus the unfair aspect of this first step becomes positively spiteful by sending out circulars broadcast over the country informing the company's customers and others that the company dealt in unfair goods, and that these goods would not be handled by organized labor.

The meaning and import of this being that any one who attempts to use goods manufactured by the company, shall have his union workmen called out on a strike. This is in effect a boycotting of the company's goods because they will not sign, the loss resulting to the plaintiffs is not over estimated by the jury at \$7,500, which is the pecuniary measure of the injury inflicted upon the company of the continued and concerted action of the defendants. The English Courts have declared that "The law which allows workmen to combine for the purpose of abolishing lawful benefits to themselves gives no sanction to combinations which have for their immediate purpose the hurt of another. That intentional infliction of damage upon a man's trade by combined action is wrongful unless just cause or excuse can be found for it.

Jas. O. Winston of Richmond, Va., has secured a patent for a new system of handling materials used in

the manufacture of concrete blocks, which consist of two parallel tracks spaced about 10 feet from centers. A wide platform car carried on four trucks, two on each side. This car takes on either the materials required to form concrete or the mixed concrete. The box forms for molding the blocks are distributed on either side of the tracks and between the two tracks the concrete is then shoveled into the forms, the platform of the car being high enough to clear the forms under the car and between the tracks. The car moves on discharging concrete into the molds. When the concrete on the platform car is all used the car returns for more. After the concrete in the forms has cured, then the blocks are loaded onto the car and carried to the storage yard, this system saves time and extra handling for a certain class of work.

The Gainer Engineering Co., of Independence, Kans., will prepare the preliminary plans for the Monarch Portland Cement Co. to be located at Humboldt, Kan.

Local capitalists of El Paso, Tex., have paid in \$250,000 for the construction of a Portland cement plant at that place. Outside parties are to contribute an equal sum. Work is to commence on the plant in July.

Okeene, Oklahoma, is negotiating with one of the large cement plaster companies to have a plaster mill located in the town, which is promised for a bonus of \$2,000 and mill site to be donated by the citizens of Okeene.

IMPORTS OF CEMENT INTO THE UNITED STATES.

WHERE FROM	APRIL				TEN MONTHS ENDING APRIL 30			
	1906		1907		1906		1907	
	Quantity in lbs.	Value in Dollars	Quantity in lbs.	Value in Dollars	Quantity in lbs.	Value in Dollars	Quantity in lbs.	Value in Dollars
United Kingdom	33,600	\$ 109	24,283,020	\$ 83,318	15,209,986	\$ 46,930	242,392,660	\$ 792,736
Belgium	6,216,117	21,809	45,275,372	137,677	110,154,112	348,140	288,779,717	902,701
France	297,600	1,019	625,700	2,273	5,919,676	21,723	23,880,484	78,124
Germany	10,531,708	35,751	42,223,707	136,420	157,945,619	528,514	392,453,111	1,230,331
All Other Europe					396	1	20,629,070	61,741
British North Am.	11,909	64	2,700	23	51,550	311	2,575,785	18,774
Other Countries	2,209,000	8,520	250,418	1,152	2,263,155	9,021	54,959,155	239,006
TOTAL	19,299,925	67,272	112,660,917	360,863	291,544,488	954,640	1,026,269,780	3,344,013
Domestic Exports of Cement, bbls.	48,904	69,365	55,935	89,013	700,754	996,112	550,967	908,768

There were 5,678,142 lbs. of imported Roman and Portland Cement, etc., in the United States bonded warehouses in April, 1906, valued at \$17,097, against 19,330,592 lbs. in April, 1907, valued at \$45,634.

For ten months ending in April, 1906, there were 58,845 tons of asphaltum imported in the United States, valued at \$263,519, against 83,658 tons imported in ten months ending April, 1907, valued at \$354,004.

THE ECONOMY OF THE LONG KILN.

Tests on 7' x 60' and 8' x 110' Rotary Kilns Burning Natural Gas.

*By E. C. Soper, South Pittsburg, Tenn., Member of the Society.

One of the most important steps in the manufacture of Portland cement is the burning or calcination of the raw material into clinker. Briefly described, the manufacture of Portland cement consists of three steps.

a) Mixing and grinding the raw material.

b) Burning.

c) Grinding the resultant clinker.

2. Because of the high cost of fuel incident to its production, the burning is of vital importance. It is not our province to go into the history of the industry nor of the burning process in particular, and we will only say that the old vertical kiln gave way to the rotary kiln, because of the greater economy in labor, and up to the last two or three years the standard size of the rotary in use was about 6' x 60'; to-day the preferred size is from 7' to 8' in diameter and varies from 60' to 150' in length, with the 100' length kiln favored by the majority of the progressive manufacturers.

3. The kiln question, however, is still in a transitory stage, because of the keen competition and rivalry among the 95 different operating companies, and reliable data are not easily available. Just what sizes will be adopted as standard, if any, would be difficult to prognosticate at the present time. There are some of the manufacturers actually claiming from 400 to 500 barrels per day per 60 foot kiln, and some of the mills in the Lehigh district with 135 foot kilns have made as high as 750 barrels per day, but as to fuel economy, the information is not given out. Whatever fuel is used in the calcining of the raw material, approximately the same number of heat units must necessarily be required per barrel of clinker burned. The rotary kiln, even in its most improved installation, is not an economical proposition in point of fuel as its highest efficiency is less than 50 per cent. In other words, the heat actually consumed per barrel is generally more than double that actually required for the calcining and chemical processes involved.

4. In an ordinary 60 foot kiln installation, it generally requires 200 pounds of coal to burn one bar-

*A paper read at the American Society of Mechanical Engineers.

rel of cement. Slack coal is generally used with the ash percentage varying from 5 to 15 per cent. Some manufacturers we believe have reduced this consumption to 85 pounds, but the majority of the average is about 120 pounds per barrel. This does not include the coal used in drying the raw materials and drying the coal itself and the coal required for power; these items will increase this amount to, say 150 pounds of coal per barrel, and with the average price of coal at \$2 gives an actual cost of fuel per barrel of 15 cents. The average cost of manufacturing Portland cement in a modern up-to-date plant in the Lehigh district is 70 cents per barrel, thus the fuel cost is 20 per cent, and this figure is a conservative average. According to the heat balance, the fuel consumption should be but one half of what is

6. The actual heat requirements in the burning process are as follows:

a) Evaporations of moisture in dry mix.

b) The driving off of the carbonates and sulphates.

c) The heating of the material to clinkering temperature. The losses occur as follows:

a) Heating and evaporation of excess moisture.

b) Heat contained in discharge of clinker.

c) Heat radiated by kiln.

d) Heat carried off by waste gases.

7. The latter process is one of the greatest sources of loss in the older installations and was the chief cause of the bringing out of the "long kiln." In a 60 foot kiln, operating dry process, the stack temperature varies from 1,000 to 1,500 degrees F, in some cases they have



Fig. 2. Gas Burner.

actually required in the best practice of to-day.

5. The burning of Portland cement by natural gas is an entirely different proposition, in point of installation, from the usual pulverized coal system. In the drawing above is given a typical installation. Gas is fed into a Kirkwood burner, of which there are many sizes. The burner is essentially a double cylinder with gas connection with the outer shell; a series of small perforated pipes perpendicular to the axis of the cylinder and equal in length to the diameter of the inner cylinder allows the gas to flow into these pipes and out through the perforations into the inner cylinder, from whence it is blown by air furnished by a blower into the kilns. Fig. 2 shows a typical "Kirkwood burner." The gas is fed into the burner or mixer under an average pressure of about 2 pounds and the air pressure varies from 1 to 6 ounces in different plants,

been measured up to as high as 2,000 degrees F. In the use of the long kiln these temperatures may be reduced in amount to 400 to 700 degrees F. and the fuel consumption correspondingly decreased. Prof. Carpenter's method of utilizing the waste heat from the ordinary 60 foot kiln under boilers is probably a more ideal method than lengthening the kiln, but for some reason, probably mechanical, it has been adopted in but one or two plants, and we understand that it is not a practical installation.

8. When natural gas was first utilized for burning in rotary kilns the number of cubic feet per barrel much exceeded that required at the present time, and even now when a kiln is first put into operation and until the lining is thoroughly "coated" the consumption per barrel is nearly double what it is after the kiln has been in operation for some time.

9. The results of the tests given below are not from one day's op-

ration but from several months' run. The heat distribution is given merely to show what work is still necessary before the heat requirements of the rotary kilns are reduced to as low a figure as is practical.

10. There is one big difference in a gas flame and the ordinary pulverized coal flame. The coal flame flares in a gradually increasing "cone" while the gas flame is similar to a "mushroom" and the heat zone is much nearer the discharge end of the kiln than in the cases of the coal burning system.

II. There are approximately 600 pounds of raw material required to produce one barrel of Portland cement clinker. A cubic foot of natural gas contains approximately 1,000 British heat units.

12. The kilns below are operating on practically the same raw material, under the same process and supervision. The proportions

ed in the case of the 60 foot kiln and cooled in the 110 foot kiln to the temperature of the stack gases. Another means of utilizing the air which has been heated by the discharged clinker and blowing same into the kiln has saved, in some instances, as high as 10 per cent of the fuel. In other words, the fuel consumption has been decreased 10 per cent.

15. It is a question now whether or not the ideal length of the kiln should be between 100 feet and 125 feet. We have noted a kiln of the latter length and 7 feet 6 inches diameter operating under precisely the same conditions as the two above, and whose monthly average output barely equaled that of the 110 foot kiln. Of course the original cost of the latter kiln is double that of the 60 foot kiln but the labor per barrel in the burning department is one-half what it is with the 60 foot kiln, and while the

through the window and illuminates the side of the drill hole, a winding drum set over the drill hole carries a cable to which the camera is attached when lowered, the entire apparatus for taking pictures is operated from above, after one view has been taken a new portion of the film is exposed and the camera is either raised or lowered for a new exposure. This device is described and illustrated in the June issue of the Wisconsin Engineer.

THE IOWA PORTLAND CEMENT
PLANT.

The new cement plant to be erected at Des Moines by the Hunt Engineering Co., is to be substantially a duplicate of the Kansas Portland Cement Company's plan at Independence, Kansas, and of the same general type as the plant under con-

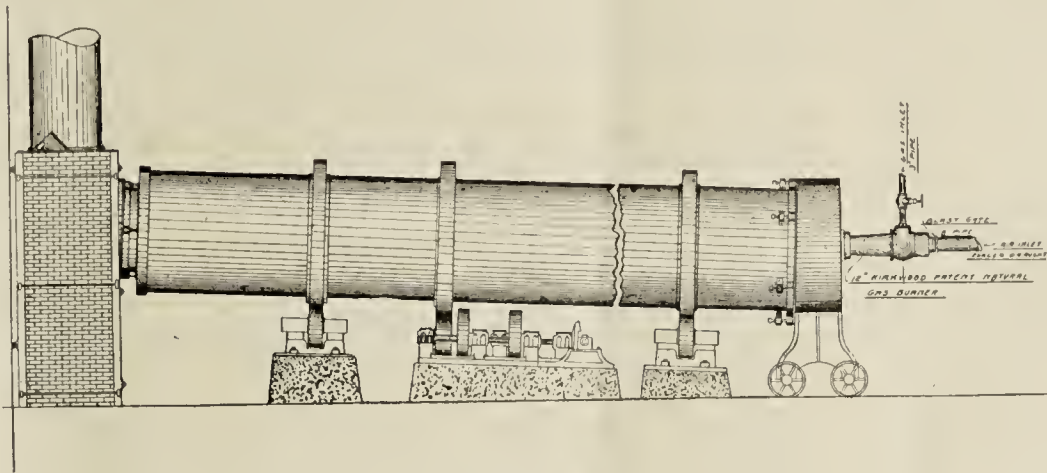


Fig 1. Kiln.

are, roughly, 75 per cent lime stone and 25 per cent shale:

13. It will be noted in the above that in the long kiln a 5 ounce pressure of air was maintained. The long kiln is a more recent installation and the question of air is one which has not been given the attention it deserves by the cement engineers. In several instances where the pressure and volume have been increased in the same kiln the output has been increased from 10 to 20 per cent. The maximum output of the long kilns is 600 barrels per day, but the figure given is maintained throughout the month, including shut downs, and is therefore, the one to be considered.

14. It will be noted that the stack temperature on the 60 foot kiln is about 1,300 degrees, and this amounts to a loss of 24 per cent of the fuel supply to the kiln. It also means another loss through the heating of carbonates and sulphates, which are liberated at about 1,000 degrees F. and which must be heat-

horse power is proportionally more in the case of the long kiln the increased fuel economy of 25 to 35 per cent will more than compensate for the interest in the increased cost of the installation and the increased horse power.

DRILL HOLE CAMERA.

J. T. Atwood, university of Wisconsin, has invented a camera for photographing the sides of drill holes where prospecting for minerals is under way. Photographs have been taken at a depth of $170\frac{1}{2}$ feet, the camera being 85 feet under water, by the aid of electric light carried in the apparatus. The camera box is formed of a 5-inch watertight tube 43 inches long, having a plate glass window near its upper end with a mirror back of the window so arranged as to reflect an image of the object opposite the window, on either side of the mirror are electric lamps and a reflector which sends the beams of light

struction by the Hunt Eng. Co. at South Pittsburg, Tennessee, excepting that the Des Moines plant will be constructed of reinforced concrete. Two special rock crushers designed by the Hunt Engineering Co. weighing 200,000 tons each will be used.

Railway sidings connecting the building site with the Chicago & Great Western Railway are about completed to facilitate the delivery of material and machinery for the plant. The company has secured deeds to 300 acres of shale and lime rock about 30 miles west of Des Moines on the Chicago Rock Island R'y. The work is to be pushed to completion with the least possible delay.

The cement rock deposits at North Topeka, Kans., are being investigated by cement experts from Independence, Kansas, with the view of erecting a cement plant thereon.

REINFORCED CONCRETE FOR WATER WORKS STAND PIPES.

By Chas. E. Burdick.

Read at the 22nd Annual Meeting of the Illinois Society of Engineers & Surveyors.

The use of reinforced concrete has been a source of general interest for several years, and engineers and laymen are accustomed to rather startling uses which have been brought to public attention from time to time the past five years. The use of this material for water works standpipes was first proposed some years ago, and since that time several structures have been built. The use of this material apparently appeals strongly at first thought to both the general public and to the engineering profession. There are, however, some difficulties to be met, and for the benefit of those who have not found the time to follow it closely, the committee has collected some facts in reference to this use of concrete which it is hoped will prove instructive to the Society.

As is well recognized, concrete in itself is not adapted to the bearing of tensile stresses owing to its non-uniformity and its liability to crack from extraneous cause. Where applied in structures, steel is imbedded in the concrete in sufficient amount to carry such tension as may occur. In standpipe construction, the governing stresses are entirely tensile; namely, the tendency of the tank to burst outward under pressure. In the use of concrete sufficient steel must be used in horizontal rings to take this stress. This is practically the method pursued in the design of steel tanks, and, therefore, in applying reinforced concrete we must use practically the same cross section of steel for horizontal reinforcement as is used in the steel structure. This may be slightly modified by the excess of steel used for stiffness in the top of steel tanks not entirely necessary in the concrete type. Upon the other hand, convenience, perhaps safety, will demand some vertical reinforcement, which has been of small amount in structures built. Therefore, we must use actually more steel in the concrete structure than would be necessary in a steel structure of the same dimensions.

The nature of the imbedded steel, however, is the key to the possibility of the use of concrete. The standpipe requires rolled plates strongly riveted together. Such work, erected in standpipes or, ele-

vated tanks at the present time costs in the neighborhood of 6 to 7 cts. per lb. Almost any shape is practicable in the concrete structure; round, twisted, corrugated or square rods or bars; and even tees have been used. Such shapes can be secured at not to exceed $2\frac{1}{2}$ cts. per lb. The use of this lowpriced material leaves a margin sufficient approximately to furnish and place the concrete. In two concrete standpipes recently completed, the cost was a few hundred dollars less than steel structures of the same dimensions.

The use of concrete for this purpose has some strong advantages. The life of the steel standpipe is evidently short, perhaps, upon the average, not more than 20 to 30 years. A case has been recently noted where approximately two tons of rust has been annually removed from the interior of a large structure. Different waters effect the steel in different degrees, and the atmosphere is always more or less active upon the outside of the tank. At the best, it must be said that steel for this purpose is relatively short lived, and requires some considerable annual expense for maintenance. To the best of our present knowledge the steel imbedded in the concrete structure is safe against deterioration, and if structural difficulties can be eliminated the concrete structure appears to be practically indestructible. At the best, the steel structure is an unsightly object. The possibilities in concrete are much more pleasing, and permit the use of brick, stucco, or terra cotta for purposes of ornamentation. The plain concrete structure, properly proportioned and relieved by simple cornices, or perhaps pilasters, can be made to look very well. Its appearance of stability and permanency is in its favor. The steel standpipe is limited in its dimensions to the thickness of plates that can be manufactured. The use of concrete is not hampered in this respect, at least within reasonable limits. It certainly permits diameters several times as great as is possible by the use of steel plate.

The use of concrete is, however, not without its objection, the foremost of which is the tendency to leakage. With ordinary concrete this is not of sufficient amount to occasion serious loss of water. Wet spots, however, will ruin the appearance of the structure, and what is more important, give foothold for the action of frost, which in a short time will peel off the exterior,

and if allowed to continue, destroy the standpipe. Apparently the most carefully laid concrete is not in itself free from this objection. To obviate this difficulty, an interior plaster coat has been resorted to. At Attleboro, Mass., where a standpipe 50x100 ft. has just been completed, four coats of plaster did not obviate entirely the difficulty. In fact, the leakage after the application was scarcely improved over that of the unplastered concrete, which, it should be said, was very small, not more than 2 per cent of the surface being damp. The interior was then coated with several washes containing alum and soap (Sylvester process), and the standpipe is said to be now satisfactory. A rich, dense concrete is, of course, desirable. The proportions used at Attleboro were 1 to 2 to 4. At Milford, O., in the construction of the standpipe 14x81 ft. built in 1903, mortar was used, mixed 1 to 3 with sand. The tendency to leak is of the utmost importance, but is believed not to be insurmountable.

The standpipe at Attleboro has a slight batter upon the outside. The standpipe at Milford is vertical outside; the difference in thickness at top and bottom being made by offsets upon the inside of the tank. The Milford structure was built under the Weber patents, largely used in chimney construction. This method of construction employs segmental forms, which are removed from below and set above the concrete in progress. By this method of procedure it is a difficult matter to construct work with a batter. The same general method was pursued at Attleboro and much difficulty was experienced in setting the segmental form so as to take care of the batter in a satisfactory manner. Some batter upon the outside of the tank is very desirable for the sake of appearance, and a considerable batter will add much to the appearance of the structure, giving it an air of solidity not otherwise attained, and appearance in a structure of this kind is something which by no means should be disregarded.

It is believed that within a covered concrete tank ice formation will be considerably reduced, and the water kept at a more even temperature both in winter and summer than is possible when stored within steel tanks. Upon the other hand, if ice forms in large masses, which may perhaps be doubted, the continual rubbing of floating cakes may endanger the structure.

An important difficulty in the

employment of this construction at present, is the fact that contractors have had little experience along this particular line. It is, therefore, believed to be practically impossible to obtain equitable bids from a number of contractors upon a fixed plan laid down by the purchaser before receiving bids. In such standpipes as have been built, so far as the committee is aware, the plan has been followed of allowing bidders to submit plans with their bids, they being previously confined only to the most general requirements. This plan usually results in a variance of design, and it is usually a matter of some difficulty to decide which bid is the best. At Attleboro, under this plan, the tensile stresses in the steel under the various plans, ranged between 13,500 and 19,000 lbs. per sq. in.; the concrete mixtures varied from 1 to 3 to 5 concrete to a 1 to 3 mortar, and all plans contemplated a waterproof interior coating of some kiln.

In the construction of large standpipe foundations a considerable saving can usually be made by the use of reinforced concrete, whether the superstructure is of concrete or steel. Nonreinforced masonry will hardly permit of a greater rate of spread than 1 horizontal to 2 vertical. In order, therefore, to get a proper spread under a large structure considerable depths are necessary, often as much as 10 or 12 ft. This is often a greater depth than is required for proper bearing, and is always deeper than necessary to guard against frost. By reinforcing the foundation with steel, using radial bars, reasonable spread can be obtained within the vertical depth made necessary by frost, not exceeding 5 or 6 ft. The saving thus secured amounts to several thousand dollars in a large standpipe.

The following tabulation shows the principal data regarding three concrete standpipes recently constructed. There are, perhaps, other standpipes of this kind now in use:

REINFORCED CONCRETE STANDPIPES.

	Waltham	Attleboro	Milford	Ft. Revere
Height.....	37 ft.	100 ft.	31 ft.	50 ft.
Inside diameter.....	100 ft.	50 ft.	14 ft.	20 ft.
Thickness of walls:				
At face.....	18 ins.	18 ins.	9 ins.	7½ ins.
At top.....	12 ins.	8 ins.	5 ins.	4½ ins.
Reinforcement:				
Horizontal.....	1½ in.*	1½ in.*	1x1x¼ Ts	½ in.
Vertical.....		4 in. channels	ditto	5\16 in. round
Max. tensile stress per sq. in. horizontal steel.....	12,000 lbs.	13,500 lbs.	21,700 lbs.	11,600 lbs.
Min. ratio cross sec. of vert. steel to concrete.....		1\110C	1\600	1\750
Proportions of concrete.....	1-2-4	1-2-4 concrete	1-3 mortar	.....

*Round bars.

some discussion by the society. It is a subject that warrants careful study, and there may be objections to this use of concrete not apparent at the present time.

The Interstate Portland Cement Co., capital \$4,500,000, incorporated under the laws of Colorado. Head office, Victoria, Kansas. Works 6 miles northwest of Independence, Kansas, where the company owns 485 acres of land 360 acres in the form of bluffs 100 feet high. The first 60 feet being shale formation overland with lime stone of an average thickness of 400 feet. The Elk River is less than one fourth of a mile from the site of the proposed plant. With the right of way for a pipe line from the river to the plant. Crane station on the A. Topeka & Santa Fe Ry., is opposite the companies land. The company propose to erect a 3,000 barrel plant. The officers of the company are: A. C. Jones, president; Sidney R. Bartlett of Colorado, vice president; Edward B. Skinner, Independence, Kans., secretary; I. F. West, assistant secretary; H. W. Lewis, treasurer, R. F. Davie, president of the Western Sugar and Land company, of Colorado Springs, and J. R. McKinnie, vice president of the Exchange National bank of Colorado Springs, the same officers, compose the directorate. The local offices will be with the Anchor Trust company. B. B. Lullebury of Philadelphia, made the report on the property.

The Sandusky Portland Cement Co., of Sandusky, Ohio, have just made a shipment of a carload of Medusa waterproof compound of the water works, Municipality of Bombay, India, and are advised that the material will be used in a cement mortar coat to be applied to the interior walls and floor of the Malabar Hill Reservoir at that point. This is

this water-proof compound by the engineers in charge is a great compliment to the product.

In the last earthquake shock at Kingston, Jamaica, a reinforced concrete dwelling house was rocked to and fro sufficiently to spill the water over the sides of a bath tub. A thorough examination of this building after the earthquake was over failed to reveal any defects in the reinforced concrete members of the building.

Portland, Oregon, is short of cement and depends upon Europe for its supply. The English ship Dalgomar, 150 days out from London, with a cargo of building material was sighted off the Columbia river. Contractors sent urgent requests to the importers to bring the ship in at once in order that the cement might be unloaded and building operations resumed. There are a number of exclusive cement cargoes now due at Portland from Antwerp and other European ports, which will keep the contractors supplied for a time.

The J. L. Ballinger Construction Co. of Columbus, O., is reported to have closed a contract with the Continental Portland Cement Co., of St. Louis, for a 2,500-barrel cement plant. The company has a West Virginia charter and was organized by J. A. Cruikshank of Bellefontaine, O., and Chas. F. Ritter of Covington, Ky.

The people of Carlyle, Kansas, a station on the Atchison, Topeka & Santa Fe Ry., believe that the A. T. and Santa Fe Ry. Company is about to locate a Portland cement plant near their town, based upon the fact that a Santa Fe agent had purchased 2,000 acres of gas lands and 80 acres of shale and lime rock near Carlyle which is about 6 miles north of Iola.

The St. Stephens Cement Land Co. of St. Stephens, Washington Co., Ala.; capital, \$50,000, has purchased 1,500 acres of land carrying raw cement materials upon which they propose to erect a 2,000 barrel cement mill. The officers of the company are: A. S. Lyons of Mobile, president; T. L. Wadsworth of Tuskegee, Ala.; W. W. Thompson, general manager, Tuskegee; J. B. Wetester, treasurer, Mobile, and S. E. McGlathery, secretary of St. Stephens.

It is the hope of the committee that this subject will be fruitful of

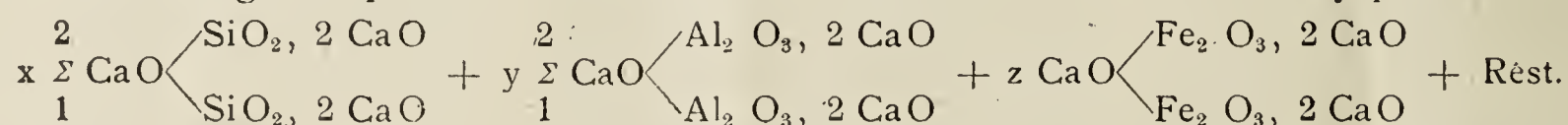
probably the largest reservoir on the continent and the adoption of

The Constitution of Portland Cement Clinker.

By Dr. Wilhelm Michaëlis Sr.

Translated by Dr. W. Michaëlis Jr.

By the remarkable research work of *Otto Schott* (thesis, Heidelberg, August 1906) and of *A. L. Day* and *E. S. Shepherd* (Journ. Americ. Chem. Society vol. XXVIII, September 1906) the existence of the calcium ortho-silicate has been established beyond doubt and its physical properties have been described in detail by the experimenters of the Carnegie Institution. According to these essays the calcium ortho-silicate (or ortho-silicate of calcium, or di- or bi-calcium silicate) occurs in three modifications of which the γ -modification is the most stable, while the α - and β -modifications are found to be stable only under certain conditions. The α -modification is stable when fused, melting point 2080°C . Below 1400°C . it changes into the β -modification and this in turn is transformed into the γ -form at about 675°C . The α and β -modifications have a specific gravity of from 3,27 of 3,28 at 25°C .; the γ -modification, on the other hand, a specific gravity about 10 per cent lower, namely 2,974; α and γ crystallize in the monoclinic and β - in the orthorhombic system. The transformation of the β - into the γ -modification on cooling of Portland cement clinker causes its spontaneous disintegration or dusting owing to the 10 per cent increase in volume of the ortho-silicate. The calcium ortho-silicate has been assumed to be present in Portland cement clinker long ago; but it was supposed to be present only under certain conditions. But from now on we have to regard it as a permanent part, nay, even as one of the main constituents of the clinker, and therefore. I am induced to return to my former formula defining the constitution of clinker. This general formula was the following: (I developed and explained this formula to Mr. *S. B. Newberry*, Sandusky, Ohio, in the course of an exchange of opinion about his so-called tri-calcium silicate in the early part of 1904):



The general formula which I published in February 1906 in the XI. volume of "Baumaterialienkunde" (see Cement & Engineering News, June 1906, "The Constitution of Hydraulic Cements") differed from this formula only by the substitution of $2 \text{SiO}_2, 3 \text{CaO}$; $2 \text{Al}_2 \text{O}_3, 3 \text{CaO}$ et $2 \text{Fe}_2 \text{O}_3, 3 \text{CaO}$; for the di-calcium compounds and by my assumption that $\frac{3}{1,5} \text{CaO}$ dissolve in the former compounds.

My motive in replacing my former formula by:

$x \frac{3}{1,5} \text{CaO} \begin{cases} 2 \text{SiO}_2, 3 \text{CaO} \\ 2 \text{SiO}_2, 3 \text{CaO} \end{cases}$ and so forth was: In the first place to include also the Roman or natural cements in this formula and in the second place to be able to distinctly define the gradual change going on during the hardening process.

If we assume Portland cement of the lowest lime limit to contain pure di-calcium compounds, we obtain, if for instance we allow to be present 4 molecules of di-calcium silicate for 1 molecule of di-calcium aluminate and di-calcium ferrite, and if we let the ratio of aluminate to ferrite be 2:1, (which is the case if 3 molecules of R_2O_3 consist of 2 molecules $\text{Al}_2\text{O}_3 = 204,4 + 1 \text{ Mol. Fe}_2\text{O}_3 = 160$; that is to say if the molecular weight of $1 \text{R}_2\text{O}_3 = 121,5$):

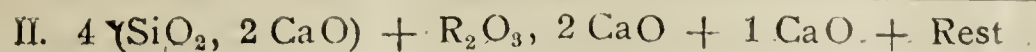
I. From the formula $4(\text{SiO}_2, 2 \text{CaO}) + \text{R}_2\text{O}_3, 2 \text{CaO} + \text{Rest}$ the following

parts by weight:	$\text{SiO}_2 = 240$
" " "	$\text{R}_2\text{O}_3 = 121,5$
" " "	$\text{CaO} = 560,0$
" " "	$\text{Rest} = 35,5$
	957,0

The hydraulic modulus in parts by weight is: $\frac{560}{361,5} = 1,55$

A cement of this composition disintegrates completely, no matter how fast it might be cooled; therefore it is a practical impossibility to manufacture it; moreover, it would not be anything better than a *puzzuolana*.

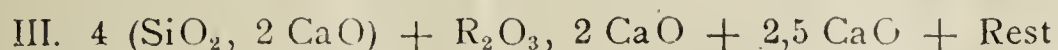
Now let us assume 1 molecule of calcium oxide to be present in addition to the 10 chemically combined molecules of calcium oxyde of the formula given under I. and let this 1 molecule of calcium oxide dissolve in the silicate, aluminate and ferrite; then we obtain:



or in parts by weight: $\text{SiO}_2 = 240$				
"	"	"	"	$\text{R}_2\text{O}_3 = 121,5$
"	"	"	"	$\text{CaO} = 616,0$
"	"	"	"	$\text{Rest} = 37,5$
				1015,0

Modulus $\frac{616}{351,5} = 1,7.$

A similar cement would correspond with the lowest line limit admissible according to the definition of Portland cement; but even this cement would disintegrate considerably and would not yield a strong mortar. If we assume 2,5 molecules of lime to go into solution, we obtain:

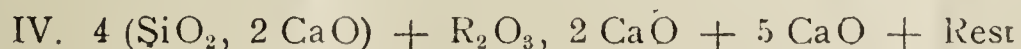


or in parts by weight: $\text{SiO}_2 = 240 = 21,68\%$				
"	"	"	"	$\text{R}_2\text{O}_3 = 121,5 = \begin{cases} 6,16\% \text{ Al}_2\text{O}_3 \\ 3,82\% \text{ Fe}_2\text{O}_3 \end{cases}$
"	"	"	"	$\text{CaO} = 700,0 = 63,23\%$
"	"	"	"	$\text{Rest} = 45,5 = 4,11\%$
				1107,0 100,00%

Modulus: $\frac{700}{361,5} = 1,936.$

This yields an excellent cement of a composition always recommended by me for the manufacture on a large scale; the same composition has been recommended and endorsed by Dr. *Otto Schott* based upon his recent studies.

If we assume 5 molecules of calcium oxide to go into solution, we obtain:



in parts by weight $\text{SiO}_2 = 240$				
"	"	"	"	$\text{R}_2\text{O}_3 = 121,5$
"	"	"	"	$\text{CaO} = 840$
"	"	"	"	$\text{Rest} = 48,5$
				1250,0

Modulus: $\frac{840}{361,5} = 2,32.$

These proportions yield a perfectly sound cement, if the raw materials have been ground very finely and have been thoroughly vitrified or even fused. This composition is still lower in lime than the fused cement which I obtained in 1892/93 and which had a hydraulic modulus of 2,4 (*Thonindustrie-Zeitung* 1893, No. 49).

As can be seen from the foregoing, the entire proceedings are quite simple and apparent; but yet it is merely a hypothesis that alite is a mixture of calcium ortho-silicate, di-calcium aluminate and calcium oxide, a solid solution which can vary within wide limits. That alite cannot be a double compound, a calcium alumina silicate, is made plain by the following deliberation: In the first place the disintegration in the absence of a sufficient amount of dissolved calcium oxide contradicts this theory. It is evident that the calcium ortho-silicate must be free and not in chemical combination with other elements; how could the change from the β - into the γ -modification otherwise be explained? In the second place the ratio of silicate to aluminate which varies within such wide limits furthermore is in opposition to this theory; thus we have a ratio of 3 silicate to 1 aluminate with clinker containing 8,2% of alumina and a ratio of 24 silicate to 1 aluminate with clinker with 1,6% of alumina.

Moreover, it is difficult to explain, how alite, crystallising in the rhombic system, with hexagonal appearance, according to *Törnebohm* can crystallize together with di-calcium aluminate which belongs to the regular system. This difficulty would be overcome, if we assume the alite group to contain mixtures of crystals composed of the β -modification of calcium ortho-silicate, which is stable at the sintering temperature of the clinker, and of tri-calcium di-aluminate, both of which crystallize in the rhombic system. Hence it is not impossible that the general formula of Portland cement clinker is:

$$x \frac{2}{1} \text{CaO} - (\text{SiO}_2, 2 \text{CaO}) + y \frac{2}{1} \text{CaO} - (2 \text{Al}_2\text{O}_3, 3 \text{CaO}) + z \frac{1}{0} \text{CaO} - (2 \text{Fe}_2\text{O}_3, 3 \text{CaO}) + \text{Rest; nay}$$

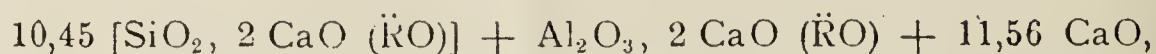
even $2 \text{ Al}_2\text{O}_3$, 5 CaO , of so far unknown crystal form may be contained in alite. Consequently the composition of alite is still obscure.

The dendritic, twig-shaped crystals or, as Dr. *Otto Schott* says, needle shaped crystals of alite in the clinker of rotary kiln cement or in fused cement I have always declared to be the result of cooling too rapidly, whereby the process of crystallization has been interrupted in its incipency and thus only a "skeleton of crystals" has been formed.

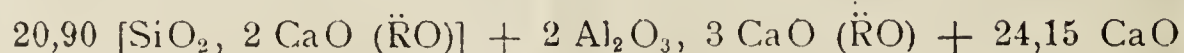
The cement of Dr. *Unger* and *Schmidt* which had been fused in an electric furnace and afterwards been cooled sufficiently slowly and which showed well-formed crystals, must be considered as pure alite, because in this cement iron and magnesia are bases and belong to the calcium oxide. Thus cement No. 3 (on page 52 of Dr. *Unger's* thesis) is pure so-called tri-calcium silicate and tri-calcium aluminate. Its composition is:

$$\begin{array}{rcl}
 \text{SiO}_2 = 23.50\% = & 39167 \text{ Mol.} \times 2 = & 78334 \text{ Mol. CaO} \\
 \text{Al}_2\text{O}_3 = 3.83\% = & 3748 \text{ Mol.} \times 2 = & 7496 \text{ Mol. CaO} \\
 & \hline
 & 42915 \text{ Mol.} & 85830 \text{ Mol. CaO chemically combined} \\
 \\
 \left. \begin{array}{l} \text{FeO} = 2.28\% = 3167 \text{ Mol.} \\ \text{MgO} = 2.34\% = 5850 \text{ Mol.} \\ \text{CaO} = 67.33\% = 120180 \text{ Mol.} \end{array} \right\} & = & 129197 \text{ Mol. CaO (}\ddot{\text{R}}\text{O)} \\
 & & - 85830 \text{ Mol.} \\
 & & \hline
 & & 43367 \text{ Mol. CaO (}\ddot{\text{R}}\text{O) in solution} \\
 \\
 \frac{129,197}{42,915} = 3; \text{ Modulus } \frac{71,95}{27,33} = 2.67
 \end{array}$$

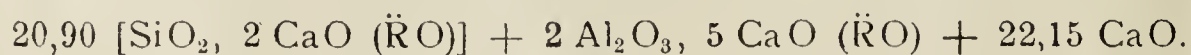
This cement, therefore, could not be sound. Its formula would be, if we assume it to be composed of di-calcium compounds:



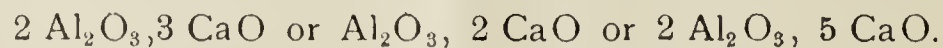
under the assumption of ortho-silicate and tricalcium di-aluminate:



and if we assume ortho-silicate and penta-calcium di-aluminate to be present, it would be:



Inasmuch as di-calcium silicate is able to dissolve half as much calcium oxide as it contains chemically combined calcium oxide, we are allowed to speak of tri-calcium silicate, but we are not permitted to call it a chemical compound, but have to designate it as a solid solution, as an alloy. *Unger's* crystallized cement proves beyond doubt, that calcium silicate, calcium aluminate and calcium oxide can form crystal mixtures, that is to say that the alite group forms a series of crystal mixtures the same as *Vogt's* melilite group. At one end of this group we should find calcium ortho-silicate and at the other calcium aluminate and it would be open to discussion whether this aluminate be



The calcium oxide dissolved in these crystal mixtures causes the solid solution originating from it easily to break up; as soon as it comes in contact with water it decomposes and a large amount of calcium oxide, very likely even more than the dissolved amount of calcium oxide, is separated in the form of calcium hydroxide. But not only water causes the separation of the dissolved lime. If we expose the clinker to long-continued red heat and even if we store and season it sufficiently long, the dissolved calcium oxide separates more or less completely; the solid solution breaks up and, if this dissociation exceeds a certain stage, where not sufficient calcium oxide remains in solution, the β -modification of the ortho-silicate changes into the γ -modification at about 675° C. and consequently the clinker disintegrates. The dissolved calcium oxide, therefore, is the cause of the stability of the β -modification; the more lime the ortho-silicate dissolves the more stable is the β -ortho-silicate.

It is a well-known fact, that alumina and iron oxide can replace each other in Portland cement. *Fried. Schott* has demonstrated this as early as 1870; but the substitution is not complete; an iron oxide-alite does not exist. Calcium ferrites do not crystallize by themselves, nor do they crystallize together with calcium ortho-silicate. The mixture of calcium ortho-silicate, calcium ferrite and calcium oxide is the celite which contains almost all ferrite as undissolved magma.

The iron-ore cement "Aegir brand" which is manufactured on a large scale at the Portland cement works "Hemmeer" has for instance the following composition:

$\text{SiO}_2 = 23,263\%$	
$\text{Al}_2\text{O}_3 = 1,671\%$	
$\text{Fe}_2\text{O}_3 = 8,199\%$	
(Mn_2O_3)	
$\text{CaO} = 64,043\%$	Formula 23,7 $(\text{SiO}_2, 2 \text{CaO}) + \text{Al}_2\text{O}_3, 2 \text{CaO}$
$\text{CaSO}_4 = 1,880\%$	$+ 3,134 \text{Fe}_2\text{O}_3, 2 \text{CaO} + 14,25 \text{CaO} + \text{Rest.}$
$\text{MgO} = 0,660\%$	

$$\text{Modulus } \frac{64,043}{33,133} = 1,933$$

The importance of the knowledge of the constitution of Portland cement clinker has evidently been greatly exaggerated of late. Certainly it is desirable to fully explain the composition of the clinker. But for our understanding of the hydraulic hardening process it is immaterial of what alite is composed or whether the clinker contains alite or celite, or in addition to these belite, felite and so forth. It would merely give us some indication as to the setting time of the cement. Moreover, we know for some time, that either alite or celite can be missing entirely and that belite and felite are no normal constituents of a perfect clinker.

The only important and essential point is, that silica and calcium oxide can react upon each other in the presence of water and that from this combination results a hardened colloid solidified as completely as possible by the influence of calcium hydrate, a colloid which must necessarily consist of calcium hydro-silicate, but which may also contain calcium hydro-aluminate and calcium hydro-ferrite. The advantages of Portland cement are its high density, its quick reaction with water due to its great surplus of lime and in consequence of that surplus its high strength.

At the last meeting of the Canadian Bee Keepers' Association several of its members were using Portland cement in the construction of Bee hives, and bee hive stands. These hives are made by first making a long cotton tube in filling it with cement mortar, which will then resemble a long sausage. This cement sausage is then coiled into the shape the bee hives is to take, one layer above the other. The cement which filters through the cotton fabric, being sufficient to form a perfect bond between the different layers, which after hardening possesses great strength. Light roads being placed on the inside four corners, as guides to give form and shape to the hive. These hives are said to be cheaper than wood, the cement coil is made about $\frac{3}{4}$ of an inch in diameter, when full of cement.

The city of Los Angeles has purchased 3,000 acres of land with a deposit of lime rock and shale thereon in the vicinity of Tehochepi, Kern county, California, upon which the city is to erect a Portland cement plant, the product of which is to be used in the construction of Owen River aqueduct.

CEMENT IN DENMARK.

According to a recent statement, the five existing cement factories in Denmark have, during 1906, had an aggregate output of 1,350,000 barrels, of which 1,150,000 barrels

have been absorbed by the home consumption, and the balance, 200,000 barrels, exported. The imports into Denmark from Sweden and Germany have amounted to a similar quantity—150,000 to 200,000 barrels. In other words, the consumption and the production have been about the same. Through the extensions which the existing five Danish cement factories recently have made, or are about to make, their production per annum will be increased so as to reach an aggregate of 2,250,000 barrels. There are at present under contemplation the erection of three new cement factories in Denmark, with an aggregate annual capacity of 500,000 to 800,000 barrels. If these works are all destined to become a reality (as to one, at least, there can be little doubt in this respect), the total production of cement in Denmark will amount to some 3,000,000 barrels. It goes without saying that the Danish market cannot consume this large quantity, and compared with the surplus, which will then be available, the present import of cement is insignificant. There will, consequently, when the projected works are in full swing, be 1,000,000 to 1,500,000 barrels of cement ready for export. It may be said, with some certainty, that such a large quantity cannot be sold advantageously, if at all. The result will, of a necessity, be that the output of the works will have to be materially reduced, to very small advantage for the capital invested in these un-

dertakings. The export cement business is not by any means such a lucrative one as many seem to imagine, and the only Danish cement factory with any export worth speaking of has had to sell cement to distant countries at a profit of 1 1-2d. to 2d. per barrel.

EFFECT OF WATER IN MIXING CONCRETE.

Prof. C. Roach of Stuttgart, Germany, has completed a series of tests covering the effect of different amounts of water used in mixing concrete test-pieces for the purpose of determining the best mixtures. These tests cover a period of over four years on samples made in the Boch laboratory, as well as samples made in various portions of the German empire representing the best German practice, which test pieces were shipped to Prof. Boch, with concrete data covering the details under which these test pieces were made.

It was found that the best results were obtained in the samples made in the Boch laboratory with the smallest amount of water consistent for ramming or tamping. When done by the best skilled workmen only, larger proportions of water enabled less skillful men to produce good concrete, with the same proportions of cement aggregates.

INCORPORATED.

The Vulcan Portland Cement Co., Montreal, Canada. Capital, \$2,500,000. To manufacture cement, lime and deal in sand, gravel, stone. The charter members include C. A. Pope, L. Mcfarlane and A. Swindelhurst, all of Montreal.

Plans for a \$300,000 Portland cement plant are under way at Lewiston, Idaho, to be located on the Snake river, 25 miles south of Lewiston. A pressed brick plant will be erected during the present season in connection with the cement project. J. O. Bender of Lewiston, is one of the promoters.

The Perfection Concrete Co. have been organized at Winnipeg, Man., with a capital of \$100,000, for the purpose of making hollow building blocks, artificial stone trimmings, lintel sills, and fence posts.

WINNIPEG INDUSTRIAL EXHIBITION.

The Winnipeg Development and Industrial bureau is making extensive preparations for the Winnipeg Industrial Exposition to be held July 13 to 20, 1907, designed to cover the home manufacturing interests of Winnipeg.

CANADA MANUFACTURING INTERESTS.

According to the Bulletin published by the Canadian Census department on June 5, 1907, Canada manufactured goods to the value of \$481,055,375 in 1905 against \$712,664,885 in 1906.

The value of manufactured goods produced in Montreal in 1905 was \$71,099,750 against \$99,746,772 in 1906. The city of Toronto produced manufactured goods in 1905 valued at \$58,415,498, against \$84,689,253 in 1906.

A Portland cement company is being organized at Glendora, Los Angeles Co., California, to construct a Portland cement plant one mile south of Glendora at the foot of the San Jose hills on lands purchased from Dr. A. E. Englehardt and a brick plant will form a part of the company's works.

The Sandusky Portland cement company is acquiring a right of

way for a railroad from Syracuse to Milford, Indiana,

The German Portland Cement Co. of Chanute, Kansas, has been incorporated under the laws of Kansas; capital, \$750,000. The works will be located on the Beebe tract just northwest of the city limits. The plant is to have a capacity of 1,000 barrels per day. W. A. Burde, president of the Fidelity Savings and Trust Co., capital \$10,000, of Bentonville, Arkansas, and C. R. Rollke of Parsons, Kansas, are the promoters of the enterprise.

THE SUPERIOR PORTLAND CEMENT CO.

The Superior Portland cement company is erecting a large plant at Baker, Skagit county, Washington, on the line of the Great Northern railway, on the banks of the Baker river. The plans were made in Chicago by R. J. Kellogg, formerly superintendent of the Pennsylvania Portland Cement Company of Bath, Pa. Mr. J. R. Kellogg is the general superintendent of the company and the erecting engineer and is to be complimented for the rapid progress being made on the work which from present indications will be completed nine months from the date of the actual construction work was commenced. Work having started April first in the present year and to be finished January, 1908. The buildings have been designed for a capacity of 4,000 barrels per day, to be completed in 1,000 barrel units. A water power dam seven miles up stream at the foot hills of Mount Baker, will furnish power under a 462 foot head, which will operate Pelton wheels; up to 9,000 h. p. being available. The kilns will be 7'6" x 7' x 125' long, built by Mosser & Sons, Allentown, Pa. The grinding machinery, Williams Mills, Ball Tube & Tube mills built by the Power & Mining Machinery Co., Cudahy, Wis. The machinery will be independent electrically driven. The company was organized under a charter from the state of Washington. The officers of the company are as follows: John C. Eden, president, of Chicago; Francis B. Clark, vice president, St. Paul; R. V. Ankeny, treasurer; Warren W. Butler, secretary; Ira Bronson, trustee, all of Seattle. The general offices of the company, Mutual Life building, Seattle, Wash. Office of the president, 1119 First National bank building, Chicago. R. J. Kellogg, general su-

perintendent and erecting engineer. Archibold S. Downey of Seattle, engineer in charge. A. W. Thompson, city engineer of Seattle, consulting engineer of the company. California oil will be used in firing the kilns. Excellent lime rock and shale constitute the raw cement material. Statistics show that the consumption of cement per capita is greater on the Pacific coast than on the Atlantic coast states, there having been a cement famine each season during the past few years in the Pacific coast states. The commercial outlook for the Superior Portland Cement Company is therefore flattering.

The Iowa Portland Cement Co. which is changing its location from Mason City to Des Moines, Iowa, has been granted exemption from taxation for a period of ten years on its plant by the city council of Des Moines, on condition that it locate within the city limits.

The Dewey Portland Cement Co. expects to complete its plant by August first and have it in operation. The plant up to date has received 442 cars of material. It was the design of the board of directors to start up the plant on July 1st, but on account of delay in receiving materials and machinery, it will not be started up before August 1st. The plant is located at Dewey, Oklahoma.

The Panama Portland Cement & Development Co. of Buffalo, N. Y., capital \$1,000,000, chartered under the laws of Delaware to manufacture cement in Alabama. Directors: J. De Money, Charles and James G. R. Cole, William A. Burmeister, all of Buffalo; C. Orvis Brown and Clarence C. Godfrey of Batavia, N. Y., and Ralph R. Dup-ton, Wilmington, Delaware. Pres. Chas. R. De Money; vice pres., J. G. R. Cole; secy., Clarence C. Godfrey; treasurer, Cowis Brown.

The International Portland Cement Co. of Hull Canada, shipped 3,242 barrels of cement on June 1st. The output for May was 50,791 barrels, being an increase of 57 per cent over the corresponding period in 1906.

The Berkshire White Portland Cement Co., of Augusta, Maine, has

been incorporated. Capital, \$250,000. The following persons are interested in the company: I. S. Kearney, E. Maynard Thompson, F. J. C. Little, J. P. Pierce, L. H. Stevens, C. C. Ballard and L. R. Merrill, Augusta, Me.

The American Cement Plaster Co. of Lawrence, Kansas, will erect a cement plaster mill at Grand Rapids, Mich., to cost \$100,000.

The Cedar Grove Building Block Company of Cedar Grove, W. Va., has been incorporated with a capital stock of \$10,000, by I. A. Luther, J. A. Quick and others.

South Charleston Concrete Construction company to quarry stone, dredge sand and construct buildings of all kinds; chief works, South Charleston; office, Charleston National bank; authorized capital, \$50,000; paid, \$10,000. Incorporators: F. M. Staunton, E. T. Crawford, J. E. Chilton, W. L. Ashby, J. D. Woodroe, J. E. Crawford, all of Charleston, W. Va.

The Casey Concrete Company of Casey, Clark Co., Ill., has been incorporated with a capital of \$2,500, to manufacture cement building blocks, by Charles T. Hill, Ira A. Fox and others.

The Trussed Concrete Steel company, located at Detroit, Mich., with a capital stock of \$1,000,000, is licensed to transact business in Illinois, with a state capital of \$25,000.

The Ajax Portland Cement Co., has been incorporated, capital \$2,000,000, seven per cent cumulative preferred stock and \$2,000,000 common stock, in shares of \$100 each. Both common and preferred shares have full voting power. The officers of the company are C. S. Gleed, pres., Kansas City; J. S. Parks, vice president, Kansas City; Geo. S. page secretary and treasurer, Kansas City; Chas. S. Keith, J. R. Crowe, F. J. Dikes, C. A. Bradley and C. S. Jobs, all of Kansas City, and B. F. Hobart, New York City. The company has purchased the Geo. T. Gurnsey farm of 230 acres two miles

northwest of Independence, Kansas. The company controls 10,000 acres of gas lands in Chataqua county. A 3,000-barrel plant is to be erected. The Westinghouse, Church & Ker Co. will construct an electric car line from Table Mound to Independence before the close of the year.

The recent cry of "dull times," raised by various manufacturing interests of the country, finds no echo in the business of Allis-Chalmers Company which continues to show a steady gain. During the month of May this company shipped from its works 553 cars of machinery, which was a gain of twenty cars over the record established for April. In April the aggregate weight of shipments was 21,680,847 lbs., while for the month of May the figure has risen to 23,772,242 lbs., making a total by weight for the two months of 45,463,689 lbs. Cars bearing this enormous quantity of machinery, if coupled in one train, would have covered a distance of about eight miles.

Incorporated, The Bronson Portland Cement Co., of Portland, Me., capital \$200,000, W. H. Jordan, Pres. and Treas. of Boston, Mass.; Charles T. Fagan, Sec'y, of Portland, Me. Certificate filed May 29, 1907.

The St. Joseph, Mo. Commercial Club and Business Men's League, visited the site of the proposed Wathena Portland Cement Plant at Wathena, Kansas. Just across the river from St. Joseph. Dr. Jean Robert Moschel the chemist who examined the property read his report, at Library Hall in the evening, which was very favorable from a promoters point of view.

H. J. Warsap of the City of Mexico, consulting engineer of the Portland cement department of the Compania Bancaria de Obras & Bienes Raices, announces that his company will construct a \$1,000,000 Portland cement plant in addition to the plant now in operation at Dublan Hidalgo, Mexico.

The Maryland Portland Cement Co., of Hagerstown, Md., is to double the capacity of its plant now under construction. Mr. Richard N. Jackson has been chosen president of the company.

The National Cement Co. of New Jersey, has been organized, authorized capital stock \$25,000,000, C. L. Murphy of Plainfield, N. J., President. The present capital stock will be \$2,000,000, of which \$1,000 has been paid in. The incorporation papers were filed at Newark, N. J., by Marcus W. Lyons, Julius C. Fitzgerald and Thomas E. Warman of Newark. The company propose to build a 2,000 barrel plant at Carpenterville, Warren Co., N. J., as well as to purchase and consolidate the interest of various plants in the Lehigh Valley according to J. K. Bailee, one of the directors of the company.

The Enameled Concrete Co. of Des Moines, Iowa, has absorbed the Iowa Concrete Brick Co. of the same place. the capital is to be increased to \$2,500,000. Prof. M. J. Reinhart, late of the engineering department of Iowa State College has taken a position with the Enamel Concrete Company as testing engineer.

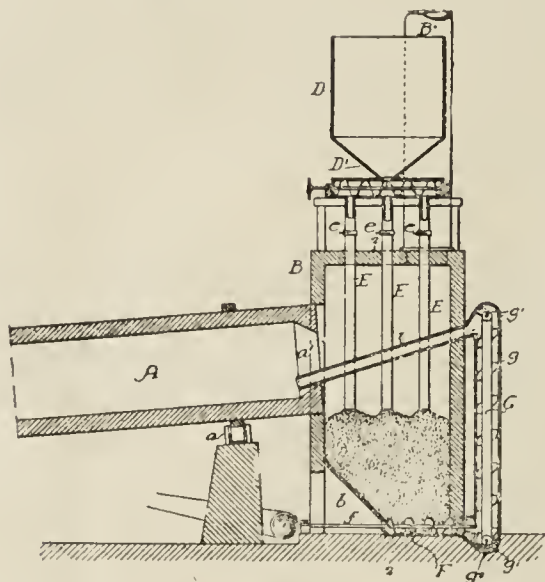
The Northwestern States Portland Cement Co. of Mason City, Iowa, is installing 10 Rotary Kilns, each 110 ft. long by 7 ft. in diameter, space for two additional kilns has been reserved, 6 Krupp ball mills are now on the ground. The company has built a long row of cottages which will be furnished and rented to its workmen at \$6.00 per month. A tressle work supported on reinforced concrete carrying a railway track across the company's land from the main track to the plant has been built averaging 10 ft. high. The power plant 202 by 75 feet has been completed. 150 men have been employed during the winter on construction work.

The National Portland Cement Co. of California, has been incorporated, capital \$5,000,000, of which \$2,500,000 is to be used in actual construction and equipment of the plant. San Jose, San Francisco, Cal., and Canadian capitalists are promoting the enterprise. The plant will be erected near Salinas, Monterey Co., Cal. Hugh Center, of St. Joe, and John M. Gardiner and Hugh Van Norden both of San Francisco are directors of the company, John M. Gardiner, Pres. The leading promoter was W. J. Lean, of St. Jose, Cal.

U. S. PATENTS RELATING TO CEMENT AND CONCRETE.

850,778. Process of making Hydraulic cement. Emil Mueller, Alsen. N. Y. Filed Feb. 11, 1907. Serial No. 356,745.

3. The process of facilitating the calcination of cement clinker, which consists in intimately mixing pulverized coal and calcium fluorid and simultaneously introducing them into the calcining-kiln.



No. 1.

850,750. Cement-kiln. William H. Harding, Philadelphia, Pa. Filed Feb. 1, 1907. Serial No. 355,223.

Claim.—1. The combination of a kiln, a combustion-chamber of the rear of the kiln having a space below the mouth of the kiln and out of the path of the products of combustion, means for supplying material to the space, and means for removing the material from the space and

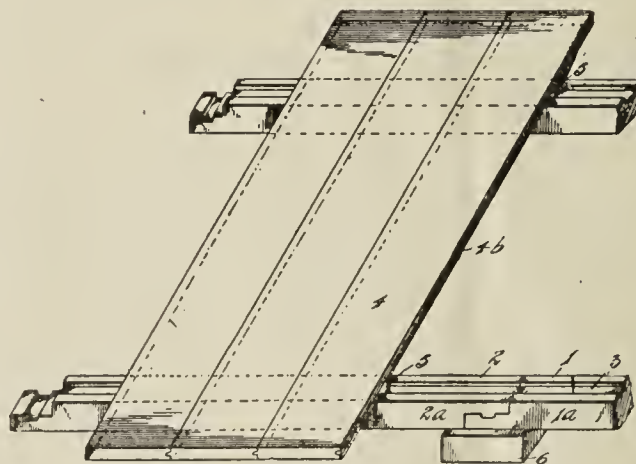
the products of combustion, and means for removing the material from the storage-space and introducing it into the kiln, substantially as described.

849,778. Impermeable cement for resisting water. Giovanni Frollo, Milan, Italy. Filed Dec. 14, 1906. Serial No. 347,779.

Claim.—1. A process for the manufacture of impermeable cement for resisting water character-

ing from the recess of one block to the recess of the block beneath it and then filling the recesses in all the blocks with water by causing the water to flow from the upper tier of blocks by way of said conduits to the recesses of the blocks in the lower tiers, and replenishing the supply of water in the recesses of the blocks in said tiers.

856,409. Concrete sidewalk. Donald G. MacDonald, Detroit, Mich.



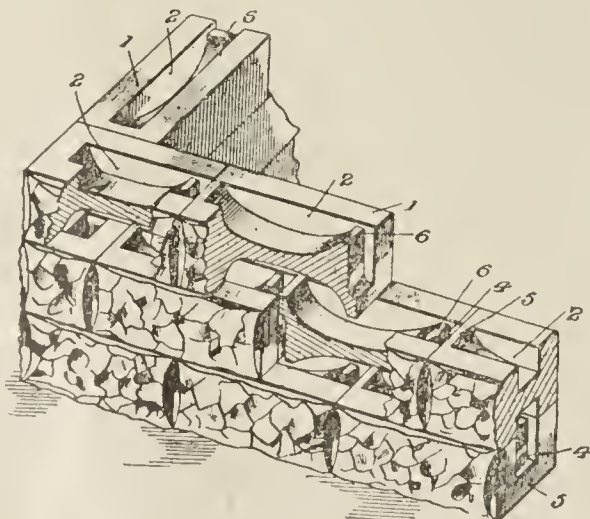
No. 3.

ized in that a mixture of liquid ingredients and a mixture of solid ingredients are required for the formation of the cement, said mixtures being composed of linseed-oil and water as liquid ingredients and of quicksand, rosin, tailors' chalk, marble and sulfate of zinc as solid ingredients substantially as described and for the purpose set forth.

849,790. Process of curing con-

crete blocks. John W. Jackson, Richmond, Va. Filed July 12, 1906. Serial No. 325,925.

3. In a concrete sidewalk, the combination of molded stringer members having ends adapted to interlock with those adjacent, their upper surfaces being indented for the reception of complementary projections, blocks beneath the meeting ends of said stringer members, and concrete tread members having



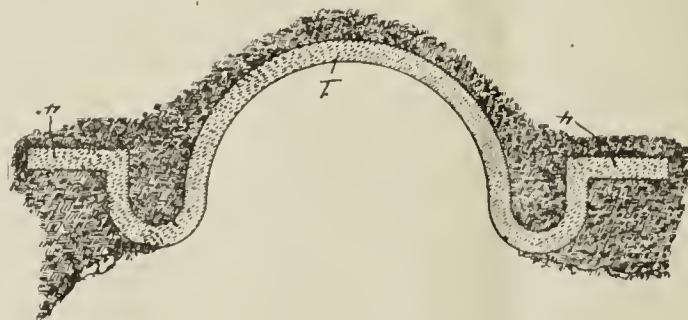
No. 2.

introducing it into the kiln, substantially described.

2. The combination of a kiln, a combustion-chamber at the rear of the kiln having a storage-space below the mouth of the kiln and out of the path of the products of combustion, means for supplying material to the space across the path of

crete blocks. John W. Jackson, Richmond, Va. Filed July 12, 1906. Serial No. 325,925.

4. The process of curing concrete blocks having a recess in one face of each block, which consists in hacking the said blocks with their recessed faces turned upward and with an open overflow-conduit lead-



No. 4.

projecting portions on their under surface adapted to engage in said indentations, each having a complementary rib on one lateral edge and a recessed portion in the other lateral edge, substantially as described.

856,702. Concrete gutter. Martin F. Howley, Pittsburg, Pa. Filed Sept. 17, 1906. Serial No. 334,851.

Claim.—1. A road drain comprising a concrete gutter, a cross section of which is in the form of a depressed drainage-receiving body-portion terminating in oppositely-disposed positioning and anchoring flanges of equal length reverse directions from the top plane of the gutter, each flange extending in a direction angular with respect to and lying without the plane of a line drawn vertically through the point juncture of the flange and the side-wall of the gutter, the body-portion and flanges being of substantially equal thickness throughout the width of the gutter.

Chas. F. Hill of Somsyville, Ky., states that a deal for 800 acres of land has been closed near Kosmosdale, Ky., 20 miles west of Louisville, upon which a New York syndicate will erect a large cement plant to cost \$4,000,000. The deeds for the land will be filed at Brandenburg, Mead Co., Ky. Work is to commence within a year. Chas. C. McCord, attorney at law of Louisville, Ky., represents the New York capitalists.

Henry Bremer reported to be from Chicago, was arrested for stealing 100 cement sacks at Joliet, Ill., from Werden Buck, a cement dealer. Brewer sold the sacks to the owner, who subsequently discovered the fact that he had purchased his own sacks from Bremer, who was arrested for the theft.

CONCRETE BLOCKS DEFY FIRE.

The recent losses on the building occupied by Montgomery & Co., furniture dealers, owned by Norman Kirkman of Nashville, Tenn., have been settled. Mr. Kirkman carried \$20,000 insurance, and received \$17,250 from the companies.

The Montgomery building was constructed of concrete blocks, this being the first tall business house in this section to be made of these blocks. The fire gutted the building but the walls remained almost intact. Insurance men throughout this section, in fact those over the entire country, are much interested in the result of the fire on these blocks. The walls were first heated from within and then rapidly cooled with streams of water. The test to which these walls were subjected was consequently severe. Samples of the blocks which passed through the fire have been obtained and

have been sent to the insurance laboratory in Chicago, where they will be carefully tested for the purpose of ascertaining exactly what effect of the fire.

LOS ANGELES CEMENT BIDS.

Bids for the furnishing of Portland cement for use in the construction of the Los Angeles aqueduct, as opened by the Los Angeles board of public works at the city hall on June 14, show that the lowest price, under existing freight rates, at which the cement can be laid down at Mojave is \$2.15 a barrel.

Western Building Material company submitted the lowest bid, which was \$1.05 a barrel for 1,250,000 barrels, f. o. b. cars at Napa Junction or Davenport, Cal. The present freight rate from Napa Junction to Mojave for cement in carload lots is \$5.50 a ton. Cement averages 400 pounds to the barrel, or about five barrels to the ton. This brings the freight rate down to \$1.10 a barrel, making the total cost a barrel at Mojave \$2.15.

The Southern Pacific agrees to make a special rate for the hauling of the cement for the aqueduct, but that this reduction would not bring the rate below \$4 a ton, or 80 cents a barrel. This makes the lowest possible figure at Mojave, taking special rates into consideration, \$1.85 a barrel.

Bid of the same company for the smaller lot of 30,000 barrels of cement was \$1.20 a barrel, making the rate, f. o. b., Mojave, \$2.30 a barrel under existing rates or \$2 a barrel under special rates.

The bids opened were as follows:

California Portland Cement company—Item 1, 30,000 barrels at \$1.75 per barrel; item 2, 1,250,000 barrels at \$1.32½ per barrel, f. o. b. cars at Colton, Cal.

Freight rate from Colton to Mojave, \$5 a ton, or \$1 a barrel.

Carl Leonardt—Item 1, 30,000 barrels at \$1.70 per barrel; item 2, 1,250,000 barrels at \$1.40 per barrel, f. o. b. cars at Cement, Cal.

Freight rate from Tolenas (Cement) to Mojave, \$5.50 a ton or \$1.10 a barrel.

Western Building Material company—Item 1, 30,000 barrels at \$1.20 per barrel; item 2, 1,250,000 barrels at \$1.05 per barrel, f. o. b. cars at Napa Junction or Davenport, Cal.

Freight rate from Napa Junction to Mojave, \$5.50 a ton, or \$1.10 a barrel.

Pacific Portland Cement company—Item 2, 1,250,000 barrels

at \$1.40 per barrel f. o. b. cars at Cement, Cal.

Iola Portland Cement company—Item 1, 30,000 barrels at \$1.60 per barrel, f. o. b. cars at Iola, Kas.

Southern California Cement company—Item 2, 1,250,000 barrels at \$1.27½ per barrel, f. o. b. cars at the factory near Riverside, in Riverside county, Cal.

Freight rate from Riverside to Mojave, \$7.80 a ton, or \$1.56 a barrel.

Said C. S. Girvan, manager of the Western Building Material Cement company, that the explanation for the low bids received is that the contract is so large that the company can afford to name a low price. He intimated that, if the demand during the next four years increased, there was a possibility of losing money on the job.

SUGAR FOR OVERWORKED HORSE.

Horses in the French army now and then are compelled to undergo excessive fatigue, which in the past has resulted in impairing the animal's constitution.

It has been demonstrated by repeated trials that a liberal sugar ration mixed in with the feed and small portions fed on the road will preserve the horse in good condition the sugar ration enabling the animal to undergo the extra fatigue without permanent injury.

The idea of the horse sugar ration was suggested by the custom of the German and French armies' practice of feeding the men sugar rations on forced marches, which enables the men to undergo great fatigue without experiencing the usual debilitating effects where no sugar ration has been taken.

NOTICE.

Sealed bids will be received at the office of the city clerk of the city of Marshfield, Missouri, up to noon on the first day of July, 1907, for the construction of about 1,000 lineal feet of cement curbing and about 10,000 square feet of cement sidewalk as per plans and specifications filed in the office of said city clerk, all work to be done by August 15, 1907, and to be paid for in special tax bills; and the right to reject any or all bids reserved.

In testimony whereof I have hereunto set my hand and affixed the seal of my office. Done by order of the board of aldermen on this 12th day of June, 1907.

(Seal)

W. P. M'KNIGHT, City Clerk.

Clancy M. Lewis, engineer of the proposed Chuckanut Portland Cement company of Bellingham, state of Washington, after investigating the cement industry in the east and west, and is now considering the enlargement of the company's plant from 2,000 barrel capacity to 5,000 barrels per day.

The Vancouver Portland Cement company's plant is being enlarged to double its present capacity. The plant is located at Tod Inlet, British Columbia.

Major C. D. Elliott, U. S. marshal at Wheeling, W. Va., together with a number of Wheeling and Parkersburg capitalists, have purchased a 400-acre tract of land having a lime stone deposite 30 feet deep together with a good shale suitable for the manufacture of Portland cement. The promoters expect to build a 1,500 barrel Portland cement plant on the property in the near future.

AMERICAN STEEL AND WIRE.

The American Steel and Wire company is doing the largest business in its history, and will earn \$20,000,000 this year. Rapid development of concrete construction is giving the wire industry an increased business, as the use of steel reinforcements in the concrete work is a factor that has already brought orders for over 100,000 tons of steel wire netting, made especially for that work. One large interest has given orders for nearly 20,000 tons. The company is spending \$3,000,000 this year for improvements.

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WANTED

A thoroughly Competent Engineer with experience in building of cement plants will be wanted in January to assist in construction work. State experience, salary wanted, references. Address A. A., P. C. W., care of Cement and Engineering News.

POSITION WANTED—Cement Superintendent, several years with large American manufacturer; thoroughly experienced, and good handler of men. Address S. J. H., Care Cement & Engineering News.

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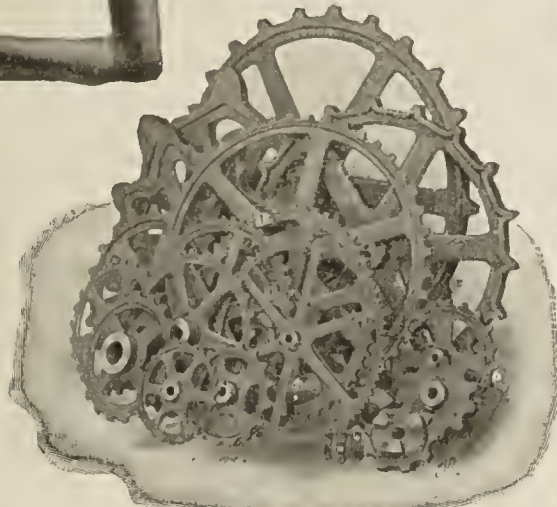
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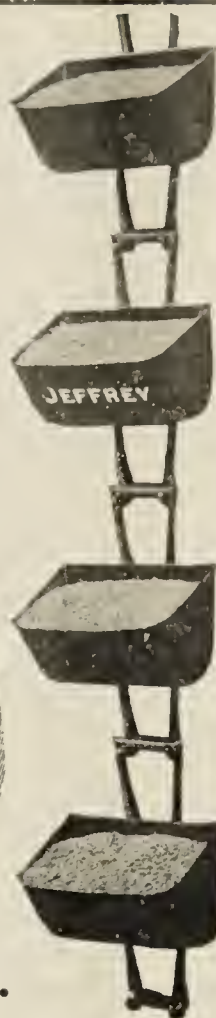


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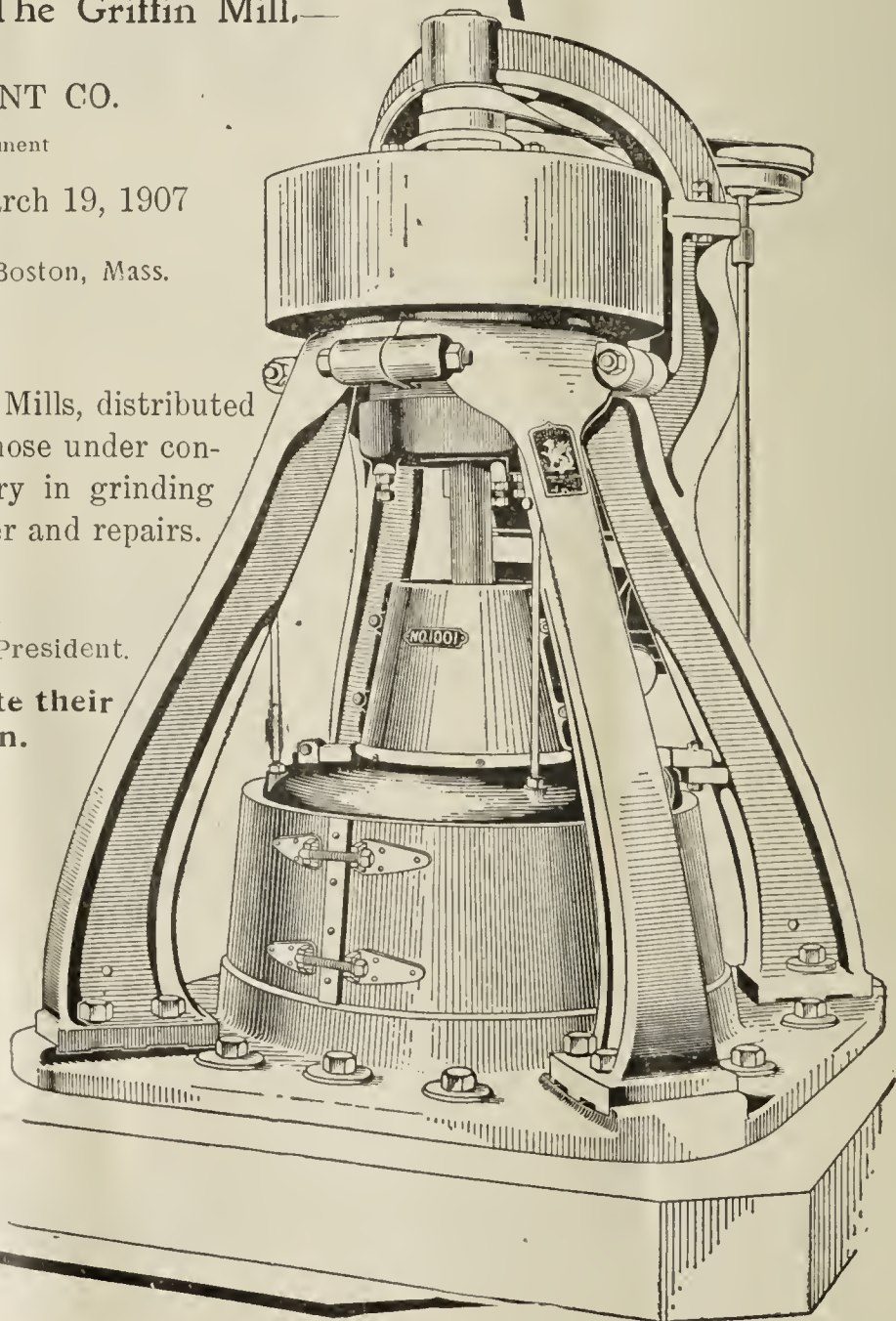
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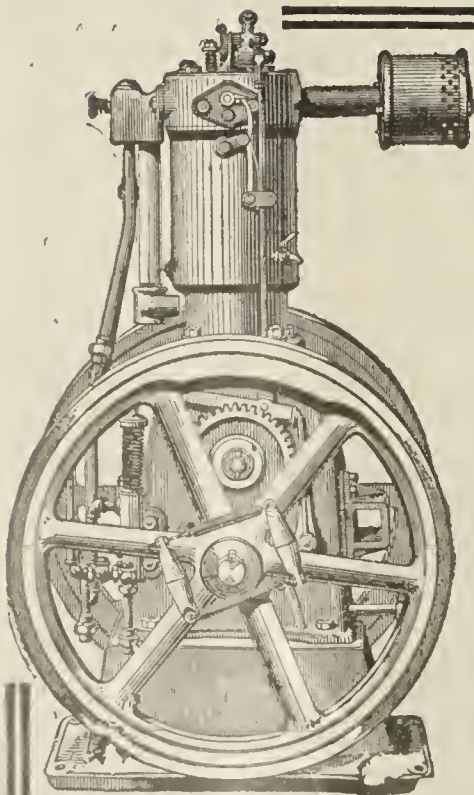
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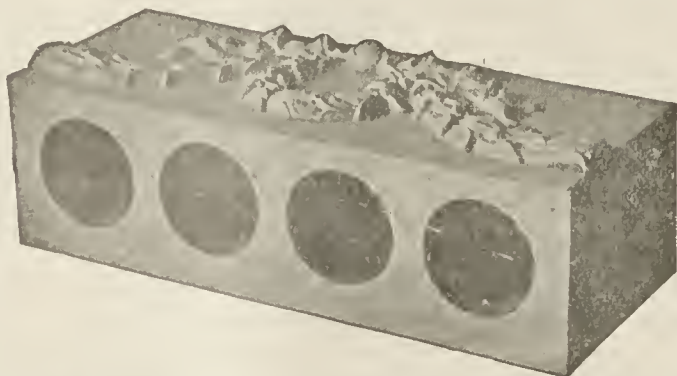
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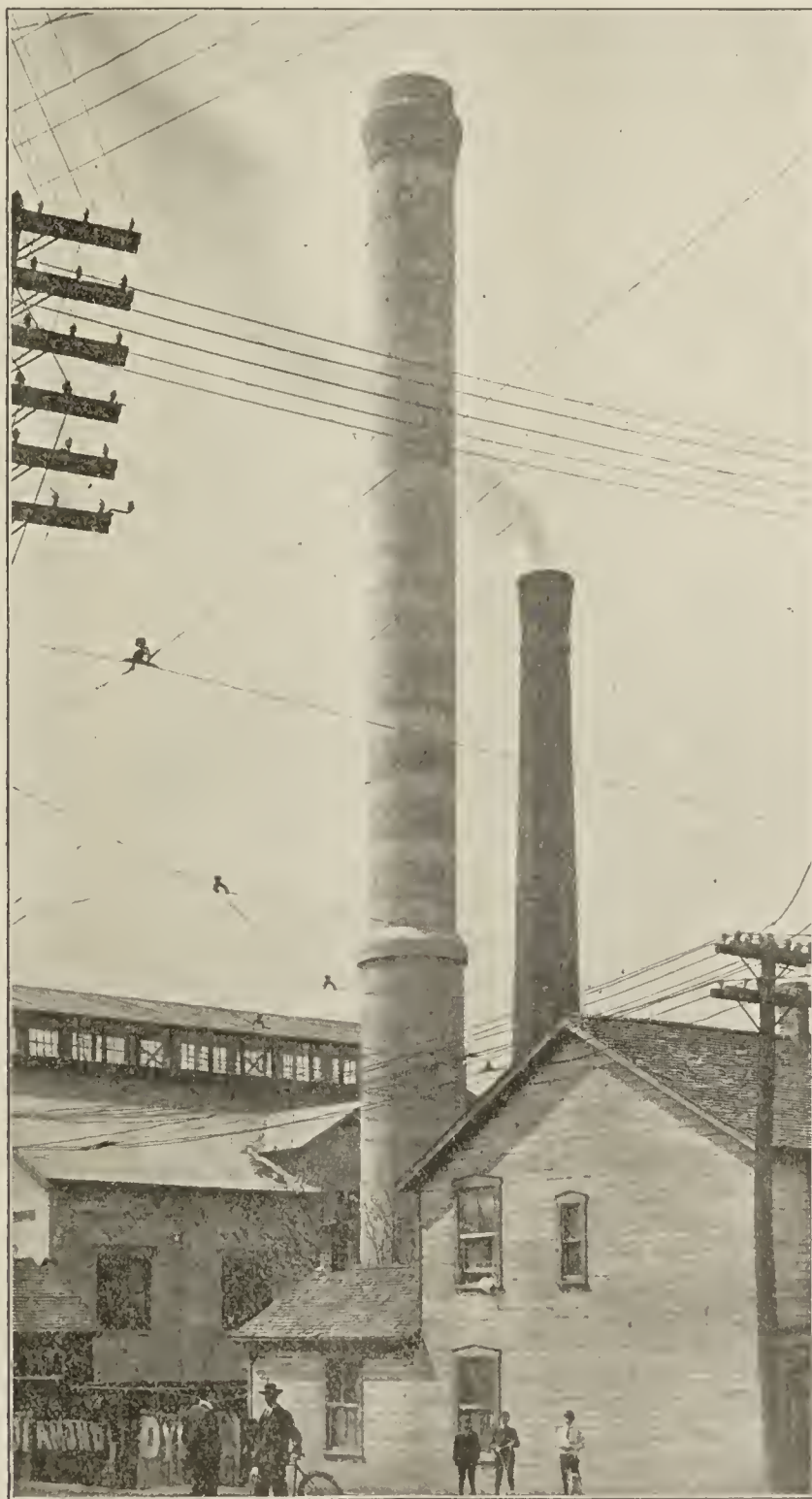
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CEMENT

.....AND.....

ENGINEERING NEWS



Woodstock Water and Light Plant.

Woodstock, Ont.—See Page 158.

CEMENT AND ENGINEERING NEWS

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CHICAGO, JULY 1907.

CORRESPONDENCE.

We solicit correspondence on all matters of general interest to the cement trade in all its branches. Engineering notes, public improvements, and facts and opinions drawn from practical experiments will be welcome.

A PROJECTED RIVAL CEMENT COMBINE.

The National Cement Company organized under a New Jersey charter has laid out for itself (on paper) the project of combining some 14 cement plants in New Jersey and Pennsylvania, outside of the big six now sheltered behind the Schwartz-Kopf Coal Burning patents. Inasmuch as the use of powdered coal in burning of cement is the foundation upon which the economic production of Portland cement rests in the United States, excepting always those regions where cheap oil and natural gas can be substituted. Should the Schwartz-Kopf patents now being litigated be sustained, it will invest the big six with a virtual monopoly or quasi control over eighty percent of our present output in the country as well as the collection of millions of dollars in royalties which would expend almost the combined capital invested in the manufacture of Portland cement in this country at the present time.

We understand that it is not the intention of the owners of these patents to either hamper or restrict the cement industry with harsh measures, but rather to use these patents, should they be sustained by the court of final resort, as a lever to regulate the production of cement upon just and equitable business principles, considering the welfare of the industry as a whole and exercising a quasi control over each plant in return for the right to use the coal process of cement burning together with a royalty exacted.

The manufacturers outside of the big six are contesting the validity

of the Schwartz patents inch by inch and have purchased for burning, powdered coal issued prior to the Schwartz-Kopf patents.

The national Cement Company without a plant or visible capital will make little headway in effecting a combine, unless the independent manufacturers are found to be the real promoters of the National Cement Co., which is improbable. Projects which are proclaimed in advance from street corners usually begin and end in wind. Clear headed financiers as a rule mature their project before they take the public into their confidence. Great manufacturing projects are never built up or torn down by simple oratory, but by cool silent persistent well directed efforts in the hands of natural born captains of industry who do not boast of their achievements.

POWDERED COAL VS. GAS IN KANSAS.

Mr. V. O. Foulk, an old time cement plant promoter, now connected with a cement company at Bedford, Ind., pops up here and there on some new cement plant project. In Ohio, for instance, his name was connected with a project which was to manufacture cement at 50 cents or less per barrel. This glittering project never matured. We now hear from him through the local press at Arkansas City, Cowley Co., Kansas, as looking up raw cement material for the purpose of locating a western branch in connection with his own plant in Indiana. He wants to locate near coal, and as Arkansas City is connected with the coal fields of the southeast, over the oil and gas fields of Kansas and make the cement plants now established in the gas belt of eastern Kansas, sick and disgusted with the business. This is the only plausible view to be taken of this project, that will induce the capitalists of Arkansas City to subscribe to the stock of Mr. Foulk's western branch. Our own private opinion, however, is that a cement plant using powdered coal fuel in Kansas, will prove a sink hole for the money invested in the enterprise. The promoters alone being excepted in this case.

The Altoona Portland Cement Co. has been organized at Kansas City, Kan., to build a cement plant in Kansas. Mr. Parker, Pres. and Mr. Richardson, Secy. of the company, state that sufficient stock has been disposed of to begin construction on the plant. The head office

is 1613 Dwight Bldg., Kansas City, Kan.

ELECTROLYSIS OF STEEL IN REINFORCED CONCRETE IN SEA WATER.

The Scientific American contained an abstract of experiments made by A. A. Knudson on the electrolysis of steel in reinforced concrete.

Mr. Knudson embedded iron pipe in a rich mixture of concrete, 1 cement to one sand. Several such test pieces were placed in sea water together with an iron electrode, a current of electricity was then applied for 30 days; the iron pipe began to show evidence of electrolysis, while another test piece of the same composition was also placed in sea water for the same period, without showing the least effect of the iron being attacked. It is a well established fact that all concrete is porous and can be substituted for the ordinary porous cups used in two fluid cells for generating the electric current. The original porous cup being made of a bullock's gullet. The porous cup today is displaced by a packing of moist sawdust found in many of our dry electric cells of today. Mr. Knudson therefore simply revived the old porous cup and sawdust packed cell in a new form and the results which he described were bound to follow, inasmuch as the breaking down of matter under the action of the electric current are of such minute dimensions that they will pass through concrete with ease.

Sir Oliver Lodge in a lecture delivered at the Birmingham university compares the atom with the electrons as follows:

"Two hundred millions of atoms of matter could lie in a single row on an inch, and it would take a hundred thousand electrons to equal the size of an atom of matter."

Mr. Knudson's experiments dealt with the electrons. People are not building reinforced concrete structures to be immersed in sea water or to be used as electrical conductors.

Steel imbedded in concrete immersed in sea water is perfectly safe. The disintegrating effect of the electric current must be present to injure the imbedded steel. The presence of steel in concrete pile is simply required during the process of seating or driving the pile in place. Even if the steel entirely disappears, the concrete will not suffer in compression due to loading, as it possesses ample strength without the steel reinforcement.

FIRE PROOF SUMMER HOTELS.

By H. L. Hiscock, Boston, Mass.

Condensed from a paper read before the National Fire Protection Association.

Poor construction is largely responsible for the numerous conflagrations in our cities and villages; the same is true of the ordinarily constructed hotel which is liable to rapid destruction by fire. The National Board of Fire Underwriters, with view to lessening the fire hazard has promulgated a building code, which it is seeking to have adopted by municipal authorities, throughout the country. This code should be extended to include season and resort hotel structures in order to insure greater safety to the guest. There are many good sound reasons for building these hotels entirely of concrete. Wood is becoming expensive, while the demand for structural steel is so great that orders cannot be filled for months after the order has been placed. Quick construction work is therefore impossible with steel. The stability and permanency of the structure should appeal to the owner, as well as the ease of maintenance and care, and of course the decreased danger from fire. Concrete made up of inert substances such as crushed stone, gravel, cinders, broken bricks, etc., bound together in a solid mass by mortar, made of sand and cement, is being used to build houses, raise giant city hotels, build the piers and bridges for railroads, erect barns and lay sidewalks. Almost anything can be done with this material and can be accomplished with incredible swiftness and cheapness of price. Therefore, a season hotel is possible by this method, and we already have a few examples. A hotel built of concrete does away with all plaster and lathing. Paper can be put right on to the walls, or they can be painted or frescoed. Building such a house does not require expert labor. The army of metal workers, bricklayers, carpenters and other artisans necessary in wood or steel construction is almost entirely done away with on a concrete building. All that is needed is an expert to superintend the making of the concrete, which is the most important part, as it is absolutely essential that this work be properly done, and a carpenter and staff to construct the molds or framework into which the soft concrete is poured. Once a concrete building is finished, the work is done and done to stay, according to all natural laws. For instance, witness the examples of concrete construction in Rome and vicinity, one of

the most notable being the famous Pantheon and its immense dome, said to be built entirely of concrete, about 25 B. C. In a century, therefore, a building ought to be in as good shape as ever. There is nothing to decay or fall into need of repair, and the building does not have to be painted yearly, as in the case of wood, or gone over for rust, as in the case of steel. The foundations and pillars never need replacing. Another great advantage for this material is that the supply is practically unlimited.

In the construction of concrete properties, great care should be exercised to determine the correctness of the mixture and to allow enough time for hardening before removing forms. It is well known that concrete, when properly mixed, becomes so hard that it takes longer to saw a given distance through a block than through equivalent granite. Failure to accomplish this proper mixture and hardening has resulted in the structure collapsing with loss of life. A tourist hotel has had an accident of this kind; this is the new "Hotel Bixby," at Long Beach, Cal., which was to be one of the finest hotels in southern California, 175 by 348 feet, and with 276 guest chambers. This collapsed in November last, when one hundred and fifty men were at work on the structure and several were killed or seriously injured. The cause was stated to be that workmen removed the supports from the concrete on top floor before it was set, and the dead weight collapsed and crowded the supports below. This hotel had been under construction for several months, and four stories of re-enforced concrete had been completed.

A well-known authority on fire-proof construction has stated that the architect is very largely to blame for poor construction from a fire protection standpoint. As a general rule, the architect lacks the conservative instinct, and the architects of both the new and the old schools know less and care less about the fire protection element which enters into the construction of a building than about any other feature. Carelessness and ignorance in the matter of inspection are also largely responsible for the kind of work that is being put into modern fire-proof buildings. Another feature which is being criticised is the lack of systematic tests of methods and materials, the only one made in this country being those by the New York Building Department, the Underwriters' Laboratories at Chicago, and at Columbia university, in

the old country, the British Fire Prevention Society are doing good work in this direction. There are 907 hotels in New England, of which 105 were totally destroyed by fire during the past nine years, while 42 were partially destroyed; the total loss being \$1,487,718.

PROPOSED CEMENT PLANT CONSOLIDATION IN JAPAN.

United States Consul Miller at Yokohama, Japan, quotes Japanese newspapers as an authority for the formation of a Japanese Cement Syndicate including three companies which are to incorporate for the purpose of checking the importation of foreign cement brands, and for the construction of two new plants, one in Manchuria, China, and one on the northeast coast of Japan, as well as to the improve the quality of cement.

We are enabled to state from private information in possession of the "Cement and Engineering News" that much of the cement now produced in Japan is of an inferior quality, several plants having an output as low as forty barrels per day. There is one good plant at Hakodate on the east coast of the southern peninsula of the Island of Ezo, in the extreme northern Japan. This plant is being overhauled, and will install two rotary kilns of German manufacture. The Assano Portland Cement Co. operates two plants, one in the southern portion of the Island of Nippon and one at Tokyo, both in charge of T. Sakauchi. One of these plants has had a rotary kiln sixty feet by six feet, in operation for over four years. This one kiln has a larger output than any rotary kiln of the same dimensions in existence, producing as high as five hundred barrels per day of sound cement. Another rotary eighty by seven feet will be installed before the close of the year. This with the 60 ft. kiln will give an output of nearly 1,200 barrels per day. The second Assano plant is being overhauled. Two 80x7 ft. kilns have been ordered, and will be installed before the close of the year. These two kilns are expected to produce about fourteen hundred barrels per day in finished cement. The new system now in operation in Japan, will revolutionize the cement industry of the world. There is considerable inferior cement produced in Japan, by small plants some of which have an output of less than fifty barrels per day.

The sound cement produced in Japan is manufactured under the supervision of European and Japanese cement experts, and the

men who have been trained by them. Wages are low in Japanese cement mills, and coal high; some of the Japanese cement companies have declared as high as 30 per cent dividends.

OLD & NEW STYLE OF CONCRETE CHIMNEY CONSTRUCTION.

A great change has taken place in concrete chimney construction. The old style consumed vast quantities of material compared with the new. For instance the first concrete chimney built some forty-seven years ago was erected for a large Irish flax mill in 1860. It was 156 ft. high, carried on a circular foundation about 44 ft. in diameter and 7 ft. 4 inches thick, conveying an octagonal 14 ft. 7 inches high by 17 ft. 10 inches in diameter. The chimney shaft about this point being 15 ft. 9 in. in diameter, diminishing to 10 ft. 4 inches at the top; the walls at the base were 3 ft. 11 inches thick, and 16 inches at the top; the diameter of the flue being 10 ft. at the base contracting to 7 ft. 10 inches at the top. Under the present modern practice as carried on by the Weber Steel Concrete Chimney Co., of Chicago, one-half of the material is saved by the introduction of steel reinforcing. Under the Weber system the chimney shaft is formed in two distinct parts, a lower double shell and a single shell above; at the point where these two shells are united an offset is formed. The two lower shells are separated by a 4-inch circular air space, the inner shell is therefore free to expand and contract and at the same time, protects the outer shell from direct contact of the hot flue gases. The inside shell is usually 4 inches thick while the outside shell varies from 6 to 12 inches thick, depending upon the height of the chimney. The single shell of the offset is from 4 to 10 inches thick; the height of the double shell varies upon several factors such as the temperature of the stack or flue gases; the object being to protect the single shell from excessive temperature which would subject it to undue expansion and contraction. The outer shell carries the weight of the structure and takes care of the bending stresses caused by the wind pressure, and protects the inner shell from sudden changes of temperature due to the weather.

(2) In order to insure even expansion and contraction, the walls of each shell are made of uniform thickness: the entire structure is reinforced with "T" bars imbedded in the concrete so placed to assist

the tension stresses to which the shells may be subjected. Our illustration shows a chimney erected at Woodstock, Ont., 125 ft. high with an outside diameter of 5 ft. 6 inches; The Weber Steel Concrete Chimney Co. was the first to make this class of reinforced concrete work a specialty. It has built up an extensive business in the United States, Canada and Europe.

A NEW CEMENT PLANT FOR SAN ANTONIO.

Stockholders of the Alamo Cement Company of San Antonio, Texas, are considering the erection of a 500-barrel plant to be located 5 miles north of San Antonio on the line of the International and Great Northern Ry., where 300 acres of land are held under an option. Charles Baumberger, Pres. of the Alamo Cement Co., and Fred Cook, a leading stockholder are in the deal, which is to be separate and independent of the old Alamo cement plant. An opportunity is to be given to the stockholders of the old company to acquire stock in the new company.

"SKELETON STEEL" REINFORCEMENT FOR CONCRETE LINTELS.

A new reinforcing member for concrete lintels is now being manufactured by Joseph Sankey & Sons, Ltd, of Bilston, Staffordshire, Eng. This "skeleton steel" reinforcement is stamped out of a single strip of metal corrugated and expanded into the form of a light girder, as shown by our illustration, not a particle of metal being wasted, each portion being arranged and utilized to take the tension and shearing strains and so proportioned that when embedded in concrete which takes up the compressive strains produces a strong and serviceable lintel. This reinforcement is placed upon the



Elevation for Skeleton Steel for Concrete Lintel.

market in stock sizes, $4\frac{1}{2}$ inches wide by three feet long, increasing in length up to 8 ft. long for a lintel 9 inches wide. Two skeleton forms are used, placed side by side. A lintel 5 ft. long should have the depth of two courses of brick. The lintels are cast on the ground and placed in position, the same as cut stone, after they are at least seven days old.

Bids for furnishing the Los Angeles, Cal., Aqueduct Department with machinery for a city cement works were opened by the Board of Public Works July 16th, and were taken under advisement. The Pacific Coast Manufacturing Company offered to furnish and install the machinery, with the exception of making the foundations, for \$52,314. Hunt, Mark & Co., incorporated, for \$53,372 and the O'Oliver Engineering Company of Philadelphia, for \$50,830.

The Logan Portland Cement Co. will elect officers of the Company on August 1st at Fenton, Mich.

Frank Beery of Atlantic, Cacc Co., Iowa, proprietor of the Atlantic Concrete Company has filed a petition in bankruptcy in the United States District Court at Council Bluffs, liabilities \$10,000, assets \$7,600 of which \$1,300 is claimed as exempt.

The Sandusky Portland Cement Company's new plant at Dixon, Ill., will have a device for arresting and collecting the kiln flue dust which is usually discharged into the air and spread over a great area surrounding the plant.

The city of Milwaukee having purchased a large tract of land near the Milwaukee cement company's plant for park purposes, the city now wants a strip of river now owned by the cement company in order that the park may be extended to the Milwaukee river, for which the sum of \$2,000 has been offered to the cement company to be paid by the parties from whom the city purchased the land. The cement company purchased this identical strip, one inch wide, including water power rights, for \$15,000 many years ago. The cement company is

willing to give this one-inch strip to the city free of cost, providing the city will recognize the cement company's water rights which the city refused to do, claiming that the Milwaukee river is a navigable stream, and not subject to private water rights. The city now proposes to condemn this water front strip by the exercise of its right of eminent domain.

OUR IMPORTS & EXPORTS.

For eleven months ending May, 1907, our imports of non-dutiable goods amounted to \$596,268,242, and \$725,742,268 dutiable goods upon which \$304,917,678 duty was collected. Among the items of goods imported duty free was \$333,577,553 classified as crude materials for use in manufacturing, and \$108,070,247 manufactures for further use in manufacturing. Our exports of domestic merchandise for the same period were valued at \$1,719,654,349 against total imports valued at \$1,322,010,510. For eleven months ending May, 1907, we imported gold to the value of \$112,344,907, and exported during the same period \$27,527,036. Silver imports, \$39,470,078; silver exports, \$51,378,474. Our cement exports to our insular possessions for 11 months ending May 1907, were as follows: To Alaska, 3,020 barrels, valued at \$10,140; to Hawaii 9,040 barrels, valued at \$15,881; to Porto Rico, 91,942 barrels, valued at \$139,269. The Philippine Islands are supplied with cement from Japan and China.

CEMENT IMPORTS INTO BRAZIL.

Brazil imported 901,535 barrels of cement in 1906. The following is a list of leading consumers and dealers in Portland cement at Rio de Janeiro, importing more than 5,000 barrels each during the first six months of 1907:

	Barrels.
Central Railway Co.	16,090
Herman Stolrz & Co.	15,755
Rio Light & Power Co.	8,020
Walker & Co.	7,620
Perfectura Municipal	5,920
Ch. Rand & Co.	6,275

German cement at Bahia, Brazil, sells from \$3.36 to \$3.66 per bbl. Belgian cement from \$3.97 to \$4.25. Freight from Germany is less than from the United States. The Germans therefore have the greater part of the cement trade of Brazil.

In Santa Domingo, American cement is designated as "Cemento Falsificado" (spurious cement), while the German cement is known as "cemento legitimo" (legitimate cement).

Five thousand and seventy-one barrels of cement were imported into Barbados in 1906, of which 300 barrels came from the United States. Cement sells from \$3 to

\$3.56 per barrel; English brands preferred.

During the period of eleven months ending May, 1907, 13,213 barrels of foreign cement were exported from this country valued at \$17,698.

PRODUCTION OF PORTLAND CEMENT IN THE UNITED STATES.

Year.	Barrels.
1870 to 1880	82,000
1880	42,000
1881	60,000
1882	85,000
1883	90,000
1884	100,000
1885	150,000
1886	150,000
1887	250,000
1888	250,000
1889	300,000
1890	335,000
1891	454,813
1892	547,440
1893	590,552
1894	798,757
1895	990,324
1896	1,543,023
1897	2,677,775
1898	3,692,284
1899	5,652,266
1900	8,484,020
1901	12,711,225
1902	17,230,644
1903	22,342,973
1904	26,505,881
1905	35,246,812
1906	45,610,822

The capacity of the mills in 1907, if worked on full time, would yield an output of 55,000,000 barrels.

R. James Kellogg, formerly general superintendent of the Superior Portland Cement Company, Seattle.

Wash., has been appointed general manager of that company.

EFFECT OF SCALE IN BOILER TUBES.

The Engineering Experiment Station of the University of Illinois has just issued Bulletin No. 11, "The Effect of Scale on the Transmission of Heat through Locomotive Boiler Tubes," by Edward C. Schmidt, M. E. and John M. Snodgrass, B. S. This bulletin describes a series of experiments begun in 1900 by the railway engineering department of the University of Illinois to determine the relation of the heat loss due to scale to the scale thickness. The experiments comprise tests on single tubes as well as tests of the entire locomotive boiler.

The results of all the tests, plotted with reference to scale thickness, show great divergence in the heat loss, which is ascribed to differences in scale structure. The bulletin is of interest to all who have to do with the operation of steam boilers in localities where pure feed water is not available. The conclusions derived from the tests are summarized as follows:—

1. That for scale of thicknesses up to one-eighth inch, the heat loss may vary in individual cases from insignificant amounts to as much as 10 or 12 per cent.

2. That the heat loss does increase with thickness in an undetermined ratio.

3. That mechanical structure of the scale is of as much or more importance than thickness in producing this loss.

4. That chemical composition, except in so far as it affects the structure of the scale, has no direct influence on heat transmission.

—L. P. Breckenridge.

IMPORTS OF CEMENT INTO THE UNITED STATES.

WHERE FROM	MAY				ELEVEN MONTHS ENDING MAY			
	1906		1907		1906		1907	
	Quantity in lbs.	Value in Dollars.	Quantity in lbs.	Value in Dollars.	Quantity in lbs.	Value in Dollars.	Quantity in lbs.	Value in Dollars.
United Kingdom . .	6,641,600	\$19,553	16,885,400	\$ 59,177	21,851,580	\$ 66,483	259,878,060	\$ 851,913
Belgium	9,091,009	25,808	16,830,048	49,793	119,245,121	373,948	315,714,931	978,182
France	2,425,700	8,724	1,004,200	3,180	8,345,376	30,447	14,779,518	55,616
Germany	33,571,428	122,232	14,090,807	49,974	191,517,047	650,746	406,543,918	1,280,305
All Other Europe . .	7,936	21	—	—	8,332	22	20,097,670	57,829
British North Am. .	1,287,650	8,533	—	—	1,339,200	8,844	3,106,983	22,686
Other Countries . .	7,546,700	29,748	927,423	5,025	9,809,855	38,769	55,886,578	264,631
TOTAL	60,572,023	214,619	49,737,878	167,149	352,116,511	1,169,259	1,076,007,658	3,511,162
Domestic Exports of Cement, bbls. . . .	55,886	83,846	64,500	101,776	756,640	1,079,958	615,467	1,010,544

There were 4,857,438 lbs. of imported Roman and Portland Cement, etc., in the United States bonded warehouses in May, 1906, valued at \$14,867, against 11,326,618 lbs. in May, 1907, valued at \$24,373.

For eleven months ending in May, 1906, there were 70,134 tons of asphaltum imported in the United States, valued at \$303,838, against 98,508 tons imported in eleven months ending May, 1907, valued at \$405,534.

THE KING ROAD DRAG.

Thousands of miles of earth roads can be greatly improved by the use of the King road drag, which will produce a reasonably smooth surface. It removes ruts and hollows by flowing the earth into these depressions, which as a rule, are caused by improper drainage, especially during the winter. The Illinois State Highway Commission urges every township to install the King road drag. For permanent results the road should be tile drained.

Description of Drag.

The exact form or style of drag to be used is not the most essential part of road dragging. Most any device will prove effective which will move a small amount of earth towards the middle of the road and at the same time slick over the surface. As the whole theory and effectiveness of road dragging depends on the moving of but a small amount of earth at a time, it is important that no road drag be used which is of heavy design. In fact the lighter and more simple the drag the more effective it usually is.

bored so that its flat face will be perpendicular to the sticks forming the connecting braces, which should be tapered at the ends so that they will fit snugly into the holes bored into the logs. The holes should not be less than two inches in diameter. The ends of the cross sticks should be split and wedges driven so as to secure the cross braces in place. The wedges should be driven crosswise of the grain of the log or plank so as not to split it. A diagonal cross brace is placed between the logs at the leading end to stiffen the frame of the drag.

The distance from the face of the back log to the face of the front log should be about three feet. The lower front edge or toe of the drag should be protected by a strip of old wagon tire, or other piece of iron about a quarter of an inch thick and three or four inches wide and about four feet long. This strip of iron should be bolted to the front log and the heads of the bolts countersunk. The strip of iron should not be carried the entire length of the front log.

shown in the sketch, so that the drag will travel at an angle of about forty-five degrees with the direction of the road.

It will be noticed from the sketch that the long hitch of the chain goes over the log around one of the cross pieces rather than through a hole in the front log. This allows the earth to slide unobstructedly along the front face of the drag.

Figure 2 shows a form of drag made from planks which are reinforced on the inner side by two-inch by six-inch strips. Both forms of drag are effective and the one that can be constructed most conveniently is the one advised. A plank drag also has a slight advantage in that the earth will more readily slide along its face than along the rougher face of a split log.

A platform of one inch boards not shown in the sketches is laid upon the cross pieces for the driver to stand upon.

The drag is not the implement to use to move large quantities of earth, nor does the maintenance of an earth road require the use of such an implement.

When the drag is properly used it spreads out the layer of impervious soil over the surface of the road, filling up the ruts and hollows until a smooth surface is secured. As a small amount of material is always to be pushed to the center, a slightly rounded effect will be given to the road, which may be increased or decreased as desired by subsequent dragging. By forcing the mud into the hollows and ruts the water must go out, running off to the side of the road. The drying out of the road is thus much facilitated and the road is made immediately firmer because the water is squeezed out.

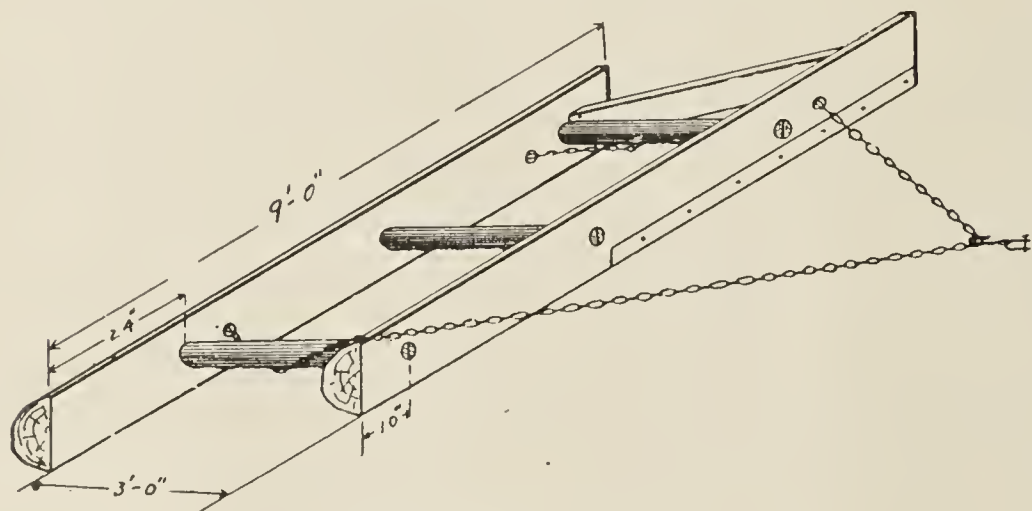


Fig. 1. Split Log Drag.

This drag is made from a ten or twelve inch log, eight or nine feet long. The cross braces are four-inch sticks shaped to fit into a two-inch hole. A board platform, not shown in the cut, is laid on the cross pieces for the driver to stand upon.

A simple stick of timber or piece of railroad iron has proved useful for this work. V-shaped drags have also been used, but it seems to meet an objection, due to the fact of their heavy draught. Perhaps the most effective form of drag is that known as the "split log drag" which may also be made of two stout planks in place of the split log. Oak or other heavy wood should not be used where it is possible to get a log of lighter wood.

Figure 1 shows a sketch for a split log drag. The log should be from ten to twelve inches in diameter and about nine feet long. The holes in the front half of the log should be bored so that a slight slant forward is given to the lower part of the front face of the split log. The holes in the rear log are

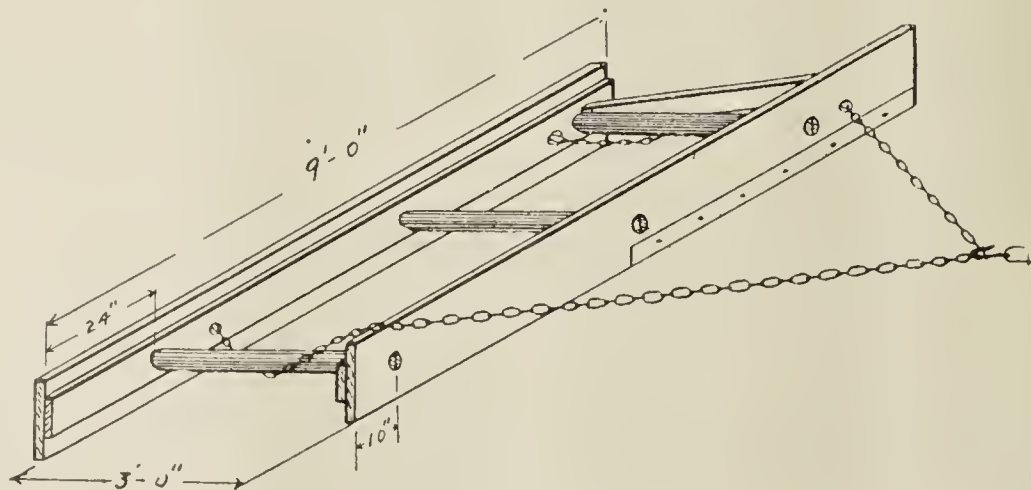


Fig. 2. Plank Drag.

This drag is made from two pieces of ten or twelve inch plank, two or three inches thick and eight or nine feet long, reinforced by a two-inch strip. The cross braces are four-inch sticks shaped to fit a two-inch hole. A board platform, not shown in the cut, is laid on the cross pieces for the driver to stand upon.

Chains should be provided with which to haul the drag, arranged with a short and long hitch as

The traffic over the road tends to press down and thoroughly compact the top of the road and each

thin layer of puddled earth which the drag spreads over the surface every time it is used. After the first few draggings it will be noticed that the road is becoming constantly smoother and harder so that the effect of a rain is scarcely noticeable, the water running off of the smooth hard surface which absorbs but little of it.

Instructions For Dragging.

The following points are to be borne in mind in dragging a road:

Make a light drag, which is hauled over the road at an angle so that a small amount of earth is pushed to the center of the road.

Drive the team at a walk.

Ride on the drag; do not walk alongside.

Begin at one side of the road or wheel track returning up the opposite side.

Drag the road as soon after every rain as possible, but not when the mud is in such a condition as to stick to the drag.

Do not drag a dry road.

If a road is dragged immediately before a cold spell it will freeze in a smooth condition.

The width of traveled way to be maintained by the drag should be from eighteen to twenty feet; first drag a little more than the width of a single wheel track then gradually increase until desired width is obtained.

Always drag a little earth towards the center of the road until it is raised from ten to twelve inches above the edges of the traveled way.

If the drag cuts in too much, shorten the hitch.

The amount of earth that the drag will carry along can be very considerably controlled by the driver, accordingly as he stands near the cutting end or away from it.

When the roads are first dragged after a very muddy spell the wagons should drive if possible to one side until the roadway has a chance to freeze or partially dry out.

The best results from dragging are obtained only by repeated applications.

Constant attention is necessary to maintain an earth road in its best condition.

CONCRETE THE GREAT MODERN INDUSTRY.

The Miracle Pressed Stone Co., of Minneapolis, Minn., has issued a large 144 page catalogue, 11 $\frac{3}{4}$ inches by 9 inches. Describing machinery and appliances used in the manufacture of concrete products and particularly those produced by the Miracle Company, illustrated by several hundred cuts and diagrams, plain and simple directions for mixing concrete together with complete specifications covering every class of material used in forming concrete with the respective values, with the cost of materials as well as the finished blocks based upon many years of experience on actual work in every part of the country where the Miracle system of construction has been employed; the data is strictly reliable; specific di-

rections are given for curing, laying and coloring blocks. The Miracle double Staggered Air space cement blocks is one of the best now on the market, having a double insulation between the inner and outer face, retarding the penetration of heat, cold and moisture which is a desirable feature giving a continuous air space throughout the length of the wall; the face of the block may be varied to include the rock faced with or without margin. Hammered faced, broken ashler, wreath belt course, plain rubbed stone effect, paneled effect. Egg and dart cornice molds, chimney block machines, cup and sill blocks, porch columns, chimney caps, lintels, form a part of the Miracle outfit. Ornamental column posts, hitching post molds, hollow or solid are specialties produced by the company. The special silo block machine with grooves for inserting steel rods to give additional strength to the silo can be purchased for \$40.00, which will enable the purchaser to engage in this business. The company likewise produce tile and pipe molds from 4 inches to 36 inches in diameter with full instructions for making and laying. Concrete mixers, cement brick machines, sidewalk tile machines and sidewalk tools are always carried in stock; every requisite from a gasoline engine to the simplest tool used in concrete construction can be had from the Miracle Pressed Stone Co., all of which is described in and illustrated in this extensive catalogue

The Report of the Royal Institute of British Architects on Reinforced Concrete.

THE REPORT.

1. Reinforced concrete is used so much in building and engineering construction that a general agreement on the essential requirements of good work is desirable.

The proposals which follow are intended to embody these essentials, and to apply generally to all systems of reinforcement.

Good workmanship and materials are essential in reinforced concrete. With these and good design, structures of this kind appear to be trustworthy. It is essential that the workmen employed should be skilled in this class of construction.

Very careful superintendence is required during the execution of the work in regard to:—

(a) The quality, testing, and mixing of the materials.

(b) The sizes and positions of the reinforcements.

(c) The construction and removal of centering.

(d) The laying of the material in place, and the thorough punning of the concrete to ensure solidity and freedom from voids.

If the metal skeleton is properly coated with cement, and the concrete is solid and free from voids, there is no reason to fear decay of the reinforcement in concrete of stone, gravel, cinder, coke-breeze, &c., made with clean fresh water.

2. The by-laws regulating building in this country require external walls to be in brick, or stone, or concrete of certain specified thicknesses. In some places it is in the power of the local authorities to permit a reduced thickness of concrete when it is strengthened by metal; in other districts no such power has been retained. We are of opinion that all by-laws should be so altered as to expressly include reinforced concrete amongst the recognised forms of construction.

A section should be added to the by-laws declaring that when it is desired to erect buildings in reinforced concrete, complete

drawings showing all details of construction and the sizes and positions of reinforcing bars, a specification of the materials to be used and proportions of the concrete, and the necessary calculations of strength based on the rules contained in this report, signed by the person or persons responsible for the design and execution of the work, shall be submitted to and approved by the local authority.

3. *Fire Resistance.*—(a) Floors, walls and other constructions in steel and concrete formed of incombustible materials prevent the spread of fire in varying degrees according to the composition of the concrete, the thickness of the parts, and the amount of cover given to the metal.

(b) Experiment and actual experience of fires show that concrete in which limestone is used for the aggregate is disintegrated, crumbles and loses coherence when subjected to very fierce fires, and that concretes of gravel or sandstones also suffer, but in a rather less degree.* The metal rein-

for at least twenty-eight days. The centering of floors in buildings which are not loaded for some time after the removal of same may be removed in a short time; the centering for structures which are to be used as soon as completed must remain in place much longer. If frost occurs during setting, the time should be increased by the duration of the frost.

13. *Testing.*—Before the detailed designs for an important work are prepared, and during the execution of such a work, test pieces of concrete should be made from the cement, sand, and aggregate to be used in the work, mixed in the proportions specified. These pieces should be either cubes of not less than four inches each way, or cylinders not less than four inches diameter, and of a length not less than the diameter. They should be prepared in moulds, and punned as described for the work. Not less than four cubes or cylinders should be used for each test, which should be made twenty-eight days after moulding. The pieces should be tested by compression, the load being slowly and uniformly applied. The average of the results should be taken as the strength of the concrete for the purposes of calculation, and in the case of concrete made in proportions of one cement, two sand, four hard stone, the strength should not be less than 2,400 lbs. per sq. in.

Loading tests on the structure itself should not be made until at least two months have elapsed since the laying of the concrete. The test load should not exceed one and a half times the accidental load. Consideration must also be given to the action of the adjoining parts of the structure in cases of partial loading. In no case should any test load be allowed which would cause the stress in any part of the reinforcement to exceed two-thirds of that at which the steel reaches its elastic limit.

METHODS OF CALCULATION.

Data.

1. *Loads.*—In designing any structure there must be taken into account: (a) The weight of the structure. (b) Any other permanent load, such as flooring, plaster, &c. (c) The accidental load.* (d) In some cases also an allowance for vibration and shock.

Of all probable distributions of the load, that is to be assumed in calculation which will cause the greatest straining action.

(1.) The weight of the concrete and steel structure may be taken at 150 lbs. per cubic foot.

(2) In structures subjected to very varying loads and more or less vibration and shock, as, for instance, the floors of public halls, factories, or workshops, the allowance for shock may be taken equal to half the accidental load. In structures subjected to considerable vibration and shock, such as floors carrying machinery, the roofs of vaults under passage ways and courtyards, the allowance for shock may be taken equal to the accidental load.

(3) In the case of columns or piers in buildings, which support three or more floors, the load at different levels may be estimated in this way. For the part of the roof or top floor supported, the full accidental load assumed for the floor and roof is to be taken. For the next floor below the top floor 10 per cent. less than the accidental load assumed for that floor. For the next floor 20 per cent. less, and so on

to the floor at which the reduction amounts to 50 per cent. of the assumed load on the floor. For all lower floors the accidental load on the columns may be taken at 50 per cent. of the loads assumed in calculating those floors.

Beams.

2. *Spans.*—These may be taken as follows: For beams the distance from centre to centre of bearings. For slabs supported at the ends, the clear span + the thickness of slab. For slabs continuous over more than one span the distance from centre to centre of beams.

3. *Bending Moments.*—In the most ordinary case of a uniformly distributed load of w lbs. per inch run of span the bending moments will be as follows:—

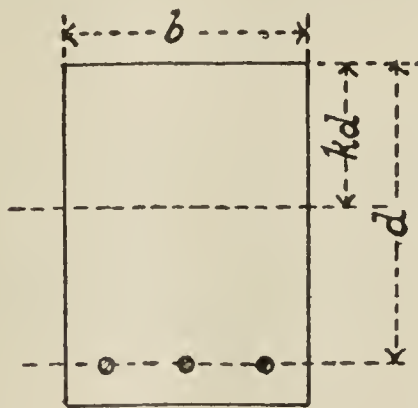
(a) *Beam or slab simply supported at the ends.*—Greatest bending moment at centre of span of l inches is equal to $wl^2/8$ in. lbs.

(b) *Beam continuous over several spans, or encastred or fixed in direction at each end.*—The greatest bending moments are at the ends of the span, and the beam should be reinforced at its upper side near the ends. If continuity can be perfectly relied on, the bending moment at the centre of the span is $wl^2/24$, and that over the supports $wl^2/12$. If the continuity is in any way imperfect, the bending moment at the centre will in general be greater, and that at the supports less, but the case is a very indefinite one. It appears desirable that generally in building construction the centre bending moment should not be taken less than $wl^2/12$. The bending moment at the ends depends greatly on the fixedness of the ends in level and direction. When continuity and fixing of the ends, whether perfect or imperfect, is allowed for in determining the bending moment near the middle of the span, the beam or slab must be designed and reinforced to resist the corresponding bending moments at the ends.

When the load is not uniformly distributed the bending moments must be calculated on the ordinary statical principles.

4. *Stresses.*—The internal stresses are determined as in the case of a homogeneous beam, on these approximate assumptions:—

(a) The coefficient of elasticity in compression of stone or gravel concrete, not weaker than 1 : 2 : 4, is treated as constant and taken at one-fifteenth of the coefficient of elasticity of steel.



lbs. per sq. in.
Coefficient for concrete $= E_c = 2,000,000$
" " steel $= E_s = 30,000,000$
 $\frac{E_s}{E_c} = 15.$

It follows that at any given distance from the neutral axis the stress per square inch on steel will be fifteen times as great as on concrete.

(b) The resistance of concrete to tension is neglected, and the steel reinforcement is assumed to carry all the tension.

(c) The stress on the steel reinforcement is taken as uniform on a cross section, and that on the concrete as uniformly varying.

5. *Working Stresses.*—If the concrete is of such a quality that its crushing strength is 2,400 to 3,000 lbs. per sq. in. after twenty-eight days, and the steel has a tenacity of not less than 60,000 lbs. per sq. in., the following stresses may be allowed:—

	lbs. per sq. in.
Concrete, in compression in beams subjected to bending ...	600
Concrete in columns under simple compression ...	500
Concrete in shear in beams ...	60
Adhesion* of concrete to metal ...	100
Steel in tension ...	15,000 to 17,000

When the proportions of the concrete differ from those stated above, the stress in compression allowed in beams may be taken at one-fourth, and that in columns at one-fifth of the crushing stress of cubes of the concrete of sufficient size at twenty-eight days after gauging. If stronger steel is used than that stated above, the allowable tensile stress may be taken at one-half the stress at the yield point of the steel.

Approximate Calculations.

Let b be the width and d the effective depth of the beam in inches.

$A = bd$ the area of cross-section.

$m = E_s/E_c$ the ratio of the co-efficients of elasticity of steel and concrete.

M = bending moment at the section considered, in inch-pound units.

t = tensile stress in metal in lbs. per square inch.

c = compressive stress in concrete per square inch.

z = distance of resultant thrust in concrete from compressed edge of beam in inches.

kd = distance of neutral axis from compressed edge in inches.

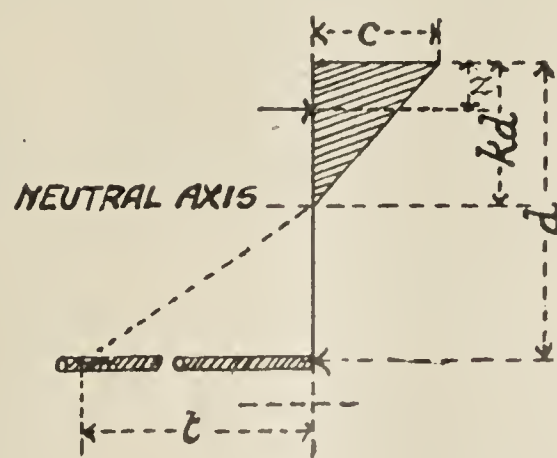
$A_c = kbd$ = area of concrete in compression in square inches.

A_t = area of metal in tension in square inches.

$p = A_t/bd$ the ratio of section of metal to section of concrete.

l = span in inches.

w = load per inch run of span.



(a) *Beams of Rectangular Section with Single Reinforcement.*—In a homogeneous beam the stresses are proportional to the distances from the neutral axis. In a dis-

* By accidental load is meant the imposed load additional to the weight of the structure for which the structure is calculated.

* It is desirable that the reinforcing rods should be so designed that the adhesion is sufficient to resist the shear between the metal and concrete. Precautions should in every case be taken by splitting or bending the rod ends, or otherwise, to provide additional security against the sliding of the rods in the concrete.

crete beam, such as a beam of concrete and steel, on account of the greater rigidity of steel, at a given distance from the neutral axis the stress in the steel will be m times as great as in concrete. Hence:—

$$\frac{mc}{t} = \frac{kd}{d(1-k)} = \frac{k}{1-k}$$

But equating the total tension and compression

$$\frac{1}{2} cbkd = pbd t$$

$$ck = 2pt.$$

Replacing c in terms of t

$$\frac{k^2}{m(1-k)} = 2p$$

$$k = \sqrt{(p^2 m^2 + 2pm)} - pm.$$

Thus for

$m =$	$p =$	$k =$
15	.007	.365
15	.010	.417
15	.015	.483
15	.020	.530

That is, the neutral axis is lower as the amount of reinforcement is greater, and passes the half depth for 2 per cent. of reinforcement.

The distance of the resultant thrust from the compressed edge is:—

$$z = \frac{1}{3} kd$$

Equating the moments of resistance to the bending moment,

$$M = A_t t (d - \frac{1}{3} kd) = \frac{1}{2} A_c c (d - \frac{1}{3} kd)$$

$$t = \frac{M}{A_t d (1 - \frac{1}{3} k)} = \frac{M}{p b d^2 (1 - \frac{1}{3} k)}$$

$$c = \frac{2M}{A_c d (1 - \frac{1}{3} k)} = \frac{2M}{k b d^2 (1 - \frac{1}{3} k)}$$

The shearing stresses and tensions near the ends of the beam are usually resisted by stirrups or inclined steel bars, and it is always desirable to bend upwards near the supports one or more of the reinforcing bars when the reduced bending moments at the ends permit of so doing. Stirrups or rigidly attached web members or inclined bars should be provided in all cases where the average shearing stress on a vertical section of the beam exceeds 60 lbs. per square inch of the section. A theoretical determination of the section required for these would be very difficult. If the simple case is taken of a uniformly loaded beam, supported at the ends with horizontal steel tension bars not bent up at the ends, the adhesion between concrete and steel which is required may be found thus: The difference of tension in 1-foot lengths of bars at the end of the span will be the tangential force between steel and concrete in that distance. The bending moment at the end is 0, and at one foot from the end $6w(1-12)$ inch-pounds, where w is the load per inch run. Hence the increment of tension between the end and 1 ft. from the end is

$$\frac{6w(1-12)}{d(1-\frac{1}{3}k)} \text{ lbs.}$$

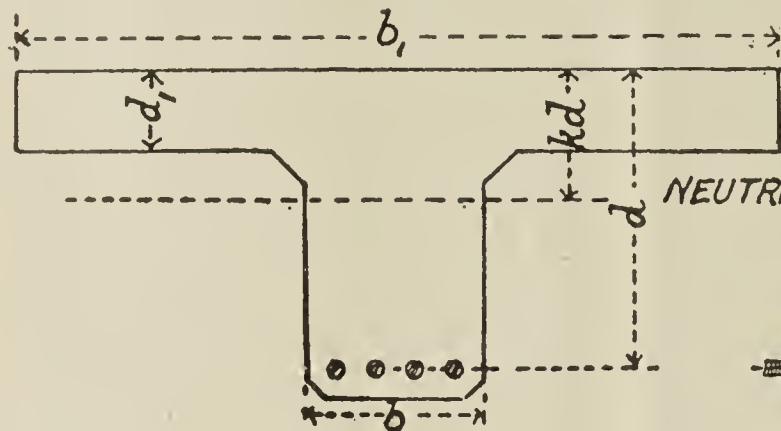
If ψ is the total perimeter of the reinforcing bars, the adhesion stress is

$$\frac{w(1-12)}{2\psi d(1-\frac{1}{3}k)} \text{ lbs. per sq. in.}$$

(b) Beams of T Section with Single Reinforcement.—In designing T beams where the upper flange forms a floor, the thickness d_1 of this will first be ascertained by considering the part between two ribs as a slab, having its own reinforcing bars transverse to the rib. The whole of this cannot in general be considered to form

part of the upper flanges of the T beams. The width b_1 of the upper flange may be assumed to be not greater than one-third the span of the beams, or than three-fourths of the distance from centre to centre of the reinforced ribs.* The depth d should then be determined with reference to the stiffness required in the floor. In general d is from $\frac{1}{12}$ th to $\frac{1}{8}$ th of the span.

Two cases arise according as the thickness of flange is greater or less than kd , the distance from the neutral axis to the compressed edge. In the former case



($d_1 > kd$) the rules under (a) apply if b_1 is substituted for b , and $A = b_1 d_1 + b(d - d_1)$ for bd . The equations then become

$$\frac{mc}{t} = \frac{k}{1-k}$$

$$k = \sqrt{\left(\frac{2pAm}{b_1 d} + \frac{p^2 A^2 m^2}{b_1^2 d^2}\right) - \frac{pAm}{b_1 d}}$$

$$= \sqrt{\left(\frac{2A_t m}{b_1 d} + \frac{A_t^2 m^2}{b_1^2 d^2}\right) - \frac{A_t m}{b_1 d}}$$

$$z = \frac{1}{3} kd$$

$$t = \frac{M}{A_t d (1 - \frac{1}{3} k)} = \frac{M}{p A d (1 - \frac{1}{3} k)}$$

$$c = \frac{2M}{A_c d (1 - \frac{1}{3} k)} = \frac{2M}{k b_1 d^2 (1 - \frac{1}{3} k)}$$

where $pA = A_t$ the section of reinforcement. The increment of tension in one foot length at the end of the beam and the adhesion stress is the same as in (a).

When d_1 is less than kd the small compression in the web between d_1 and kd may be neglected.

Let, as before, the whole area of section $= A = b_1 d_1 + b(d - d_1)$, and pA be the area of reinforcement.

$$\frac{mc}{t} = \frac{k}{1-k}$$

The mean compressive stress on the flange is

$$\frac{1}{2} \left\{ c + c \frac{kd - d_1}{kd} \right\} = \frac{c}{2} \cdot \frac{2kd - d_1}{kd}$$

Equating the total tension and compression,

$$A_t t = pA t = \frac{1}{2} b_1 d_1 c \frac{2kd - d_1}{kd}$$

$$kd = \frac{b_1 d_1^2 + 2pAmd}{2b_1 d_1 + 2bAm} = \frac{b_1 d_1^2 + 2A_t md}{2b_1 d_1 + 2A_t m}$$

$$\text{But } z = \frac{d_1}{3} \cdot \frac{3kd - 2d_1}{2kd - d_1}$$

Equating the moments

$$M = A_t t (d - z) = pA t (d - z)$$

$$= \frac{1}{2} b_1 d_1 c \frac{2kd - d_1}{kd} (d - z)$$

$$t = \frac{M}{pA (d - z)}$$

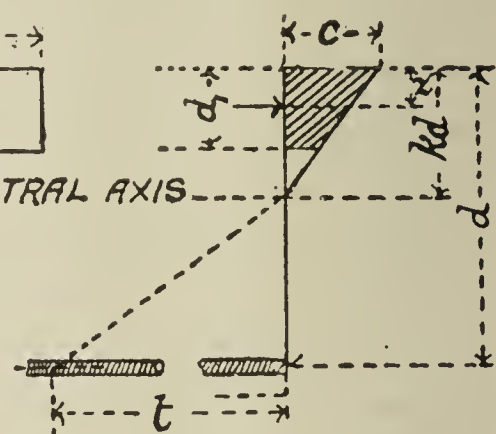
$$c = \frac{2Mkd}{b_1 d_1 (2kd - d_1) (d - z)}$$

It may be useful also to point out that the area of reinforcement for a given value of c/t is

$$A_t = pA = \frac{c}{t} \cdot \frac{b_1 d_1 (2kd - d_1)}{2kd}$$

(c) Slabs Supported or Fixed on more than Two Sides.—It does not appear that there is either a satisfactory theory or trustworthy experiments from which the strength of rectangular slabs supported or fixed on all four edges can be determined.

(See appendices for a statement of some rules which have been used in determining the strength of slabs.)



Columns or Pieces subjected to Thrust.

The reinforcement of columns should in general amount to at least 0.8 per cent. of the gross cross-section. The liability to bending of the longitudinal reinforcing bars greatly weakens the column, and should be prevented by steel binding bars. Some theoretical considerations would indicate that cross binding is required at points not further apart than twenty-four times the least lateral dimension of the reinforcing rods. But experiment shows that still closer cross binding, or better, spiral binding,* greatly increases the strength of the column.

(a) Short Columns Axially Loaded.—If the load is strictly axial the stress is uniform on cross-sections. Let A_c be the cross-section of the column (including the reinforcement), and A the equivalent section as defined below, a the section of longitudinal reinforcing bars, P the load on the columns in pounds. Let c be the stress of the concrete, and t that on the steel, the ratio of the co-efficients of elasticity being m .

$$c = \frac{P}{A_c + (m-1)a} = \frac{P}{A}$$

$$t = \frac{mP}{A_c + (m-1)a} = \frac{mP}{A}$$

It appears that c may be taken = 500 lbs. per sq. in., $t = 7,500$ lbs. per sq. in., and $E_s/E_c = m = 15$.

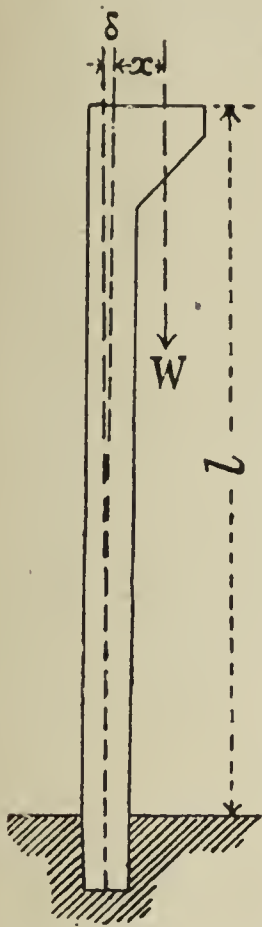
When the stress on the concrete is not greater than 500 lbs. per sq. in., lateral bending of the column as a whole is not to be feared if the ratio of length to the least lateral dimension is not greater than 18.

(b) Columns Eccentrically Loaded.—If a column initially straight is loaded eccentrically, as when a beam rests on a bracket attached to the column, it may be regarded as fixed at the base and free at the loaded end. Then it must bend in the plane passing through the load, the de-

* M. Considère recommends that the distance between the coils of the spiral should not exceed from $\frac{1}{10}$ th to $\frac{1}{4}$ th of the diameter of the spiral. In the case of piles subjected to longitudinal shock in driving there are special reasons for decreasing the distance between the cross binding near the ends.

* There is no satisfactory theoretical determination of the precise amount of the floor slab acting with the web.

flexion at the top being δ . Let x be the eccentricity of the load measured from the centre of the column when straight. Then the bending moment at the base of the column is $w(\delta+x)$. But it is known that δ will be small compared with x , provided that w is small compared with $2EI/l^2$, and this will be the case in such conditions as are likely to occur in designing concrete columns. Then the bending



moment may be taken as $w x$, and the stress at the base of the column, treating it as homogeneous, will be:—

$$f = w \left\{ \frac{1}{A} \pm \frac{x}{Z} \right\}$$

very nearly, where A is the whole section of the column, and Z the modulus of the section relatively to an axis through the centre of gravity and at right angles to the plane of bending.

In dealing with reinforced columns which are not homogeneous, it is convenient to substitute for the actual section of the column what may be termed the equivalent section, or section of concrete equivalent in resistance to the actual column.

If A_c is the area of section of the column (including the area of reinforcement), and a is the area of reinforcement, then the equivalent section is:—

$$A = A_c + (m-1)a.$$

If h is the depth of the section in the plane of bending, the moment of inertia relatively to the neutral axis can be expressed

in the form $I = n A h^2$; and the section modulus in the form $Z = \frac{1}{2} n A h$. (See Appendix III.)

It is desirable in columns that there should be no tension, and generally when the vertical load is considerable there is none. Cases in which the eccentricity is so great that there is tension must be treated by the methods applicable to beams if it is made a condition that the steel carries all the tension. In the following cases it is assumed that there is no tension.

Case I.—Column of Circular Section, Reinforced Symmetrically to the Neutral Axis.—Let m be the ratio E_s/E_c of the coefficients of elasticity of steel and concrete, A_c the cross-section of the column in square inches, a the area of reinforcement in square inches, h the diameter of the column, h_t the distance between the reinforcing bars perpendicular to the neutral axis. Then the equivalent section is,

$$A = A_c + (m-1)a$$

and the modulus of the section is (Appendix III.)

$$Z = \frac{1}{8} A_c h + \frac{1}{8} (m-1) a \frac{h_t^2}{h}.$$

The stress at the edges of the section can then be calculated by the general equation

$$f = w \left\{ \frac{1}{A} \pm \frac{x}{Z} \right\}$$

where x is the eccentricity of the load in inches and w the load in pounds. The greater value of f must not exceed the safe stress stated above.

Case II.—Rectangular Section with Reinforcement Symmetrical to the Neutral Axis.—Using the same notation as in the last case, h being now the depth of the section in the plane of bending, the section modulus is (Appendix III.)

$$Z = \frac{1}{8} A_c h + \frac{1}{8} (m-1) a \frac{h_t^2}{h},$$

and the stresses are given by the same equation as in the previous case.

Case III.—Column of Circular Section with Reinforcing Bars arranged in a Circle.—Using the same notation as in Case I., h_t being the diameter of the circle of reinforcing bars, the section modulus is (Appendix III.)

$$Z = \frac{1}{8} A_c h + \frac{1}{8} (m-1) a \frac{h_t^2}{h},$$

and the stresses are given by the same equation as in Case I.

(c) Long Columns Axially Loaded.—For columns more than 18 diameters in length there is risk of lateral buckling of the column as a whole. The strength of such columns would be best calculated by Gordon's formula, but there are no experiments on long columns by which to test the values of the constants for a concrete or concrete and steel column. There does not seem, however, to be any probability of serious error if the total load is reduced in a proportion inferred from Gordon's formula to allow for the risk of buckling.

Let, as before, A_c = the section of the column in inches; a = the area of reinforcement. Then $A = A_c + (m-1)a$ is the equivalent section. Let n be the constant in the equation, $I = n A h^2$ (Appendix III.), and h the least transverse dimension of the column.

Then for a column fixed in direction at both ends, Gordon's formula is

$$\frac{w}{A f} = \frac{1}{1 + \frac{l^2}{c n h^2}} = \frac{1}{1 + k}$$

so that the column will carry less than a short column of the same dimensions in the ratio of $1+k$ to 1, or, in other words the column will be safe if calculated as a short column, not for the actual load w , but for a load $(1+k)w$.

The constant c has not been determined experimentally for reinforced long columns. But its probable value is—

$$c = \frac{4\pi^2 E_c}{f}$$

where f is the ultimate crushing stress. Putting $E_c = 2,000,000$ and $f = 2,500$, then $c = 32,000$. Looking at the well-understood uncertainty of the rules for long columns, very exact calculation is useless. Some values of n for ordinary types of column are given in Appendix III. Taking these values, the following are the values of $1+k$:

	Values of $1+k$.		
	Case 1.	Case 2.	Case 3.
$\frac{l}{h}$	$n=0.098$	$n=0.075$	$n=0.0646$
20	1.13	1.17	1.19
25	1.20	1.26	1.30
30	1.29	1.38	1.44

The differences of $1+k$ for considerable differences of n are not very great. In any case n can be found by the method in the appendix with little trouble.

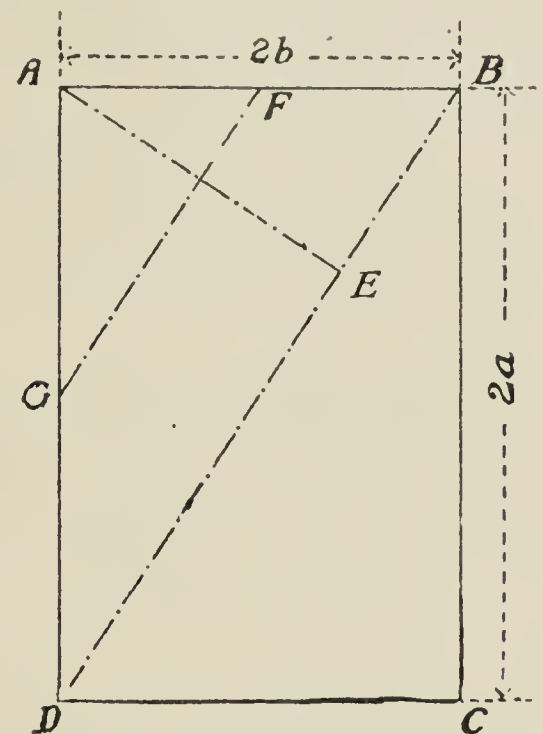
In the case of columns fixed at one end and rounded or unfixed at the other, $2k$ must be substituted for k . If the column is rounded at both ends, $4k$ must be substituted for k .

APPENDIX I.

Bach's Theory of the Resistance of Flat Slabs supported on all Edges and Uniformly Loaded.

By W. C. Unwin.

The experiments of Professor Bach show that a flat square slab supported all round fractures along a diagonal, and the greatest stress is therefore on the diagonal section. It is the same apparently with rectangular slabs, though the evidence is not quite so clear. But if a diagonal fracture is assumed a very simple theory gives the stress.



Let the figure represent a rectangular slab with sides $2a$ and $2b$ in inches. Let the diagonal $BD = d$; the thickness of the slab $= h$; the perpendicular on the diagonal $AE = c$; draw FG bisecting the sides, and let p be the load per square inch. Consider the left-hand half of the rectangle. The total load on it is $2pab$, acting at the centre of gravity of ABD , or at $c/3$ from the diagonal. Whatever the distribution of the reactions of the supports, from symmetry, the reaction on AB must act at the centre F of AB , and the reaction on AD must act at the centre G of AD . Hence the resultant of the reactions on AB , $AD = 2pab$ must act at some point on the line FG , or at a distance $c/2$ from the diagonal. Hence the bending moment on the diagonal section is

$$M = 2pab \left(\frac{c}{2} - \frac{c}{3} \right) = \frac{pabc}{3},$$

the stress at the diagonal section is

$$f = \frac{6M}{dh^2} = 2p \frac{abc}{dh^2}.$$

But $cd = 4ab$,

$$d^2 = 4a^2 + 4b^2,$$

$$f = 2p \frac{a^2 b^2}{a^2 + b^2} \frac{1}{h^2}$$

The following form of the equation is convenient:—

$$f = \frac{1}{2} \frac{\left(\frac{a}{b} \right)^2}{1 + \left(\frac{a}{b} \right)^2} \frac{w}{h^2}$$

Where w is the total load on the slab :

$\frac{a}{b} =$	$f =$
1	$0.25 \frac{w}{h^2}$
1.5	$0.23 \frac{w}{h^2}$
2	$0.20 \frac{w}{h^2}$

It would seem that if Bach's formula is to be used in calculating slabs, the reinforcing rods should be perpendicular to the diagonals of the rectangle.

APPENDIX II.

Comparison of the Results given by various rules for the Strength of Rectangular Slabs supported on all Edges and Uniformly Loaded.

By William Dunn.

The theories of Professor Grashof and of Professor Rankine assume that the maximum bending stress on the slab is at the centre, where there are two principal stresses on planes normal to each other, these planes coinciding with the major and minor axes of the slab.

The stress on the plane formed by the major axis of the slab (which is the greater of the two principal stresses) may be found in a simple manner as follows:—

Let the length of the slab = a , and the breadth = b (where a is equal to or greater than b).

Calculate the bending moment on the slab (disregarding the end supports) as a beam supported or fixed at the sides only, of a span b under the total load on the slab. Multiply this bending moment by the factor s in the following table, to allow for the effect of the end supports. The result is the actual bending moment on the long axis of the slab (see table below).

The stress on the section formed by the long axis of the slab is found in the usual way by equating this actual bending moment to the moment of resistance of that section.

Similarly the stress on the plane formed by the minor axis of the slab is found by assuming the slab supported or fixed at the ends (disregarding the effect of the side supports), calculating the bending moment as if the slab were a beam of span a under the total load on the slab. Reduce the bending moment so found by the factor r in the table below, and the result is the actual bending moment on the short axis of the slab.

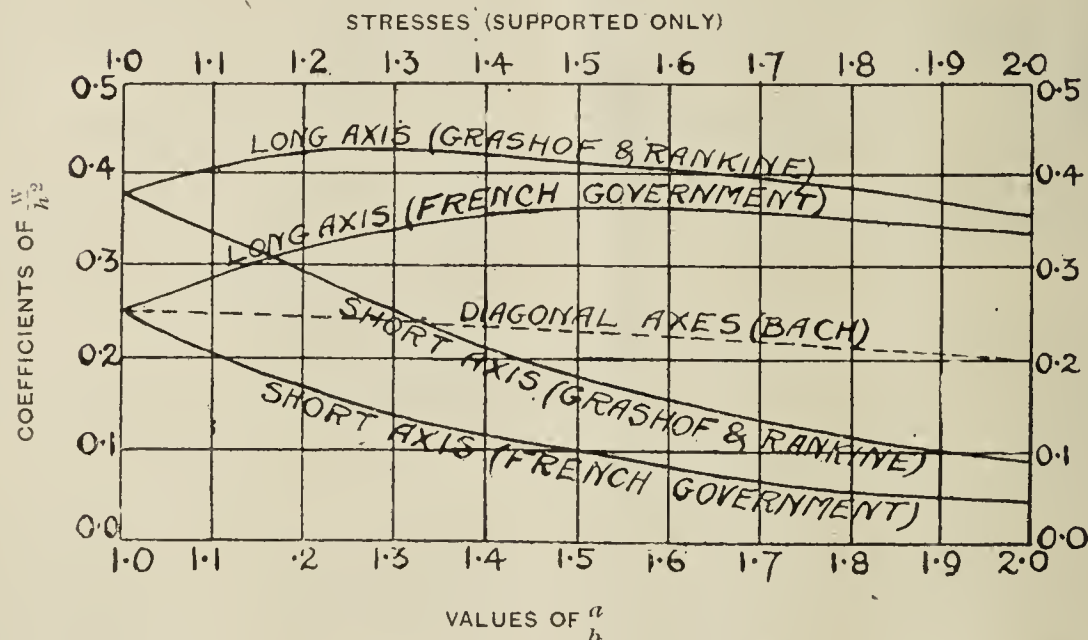
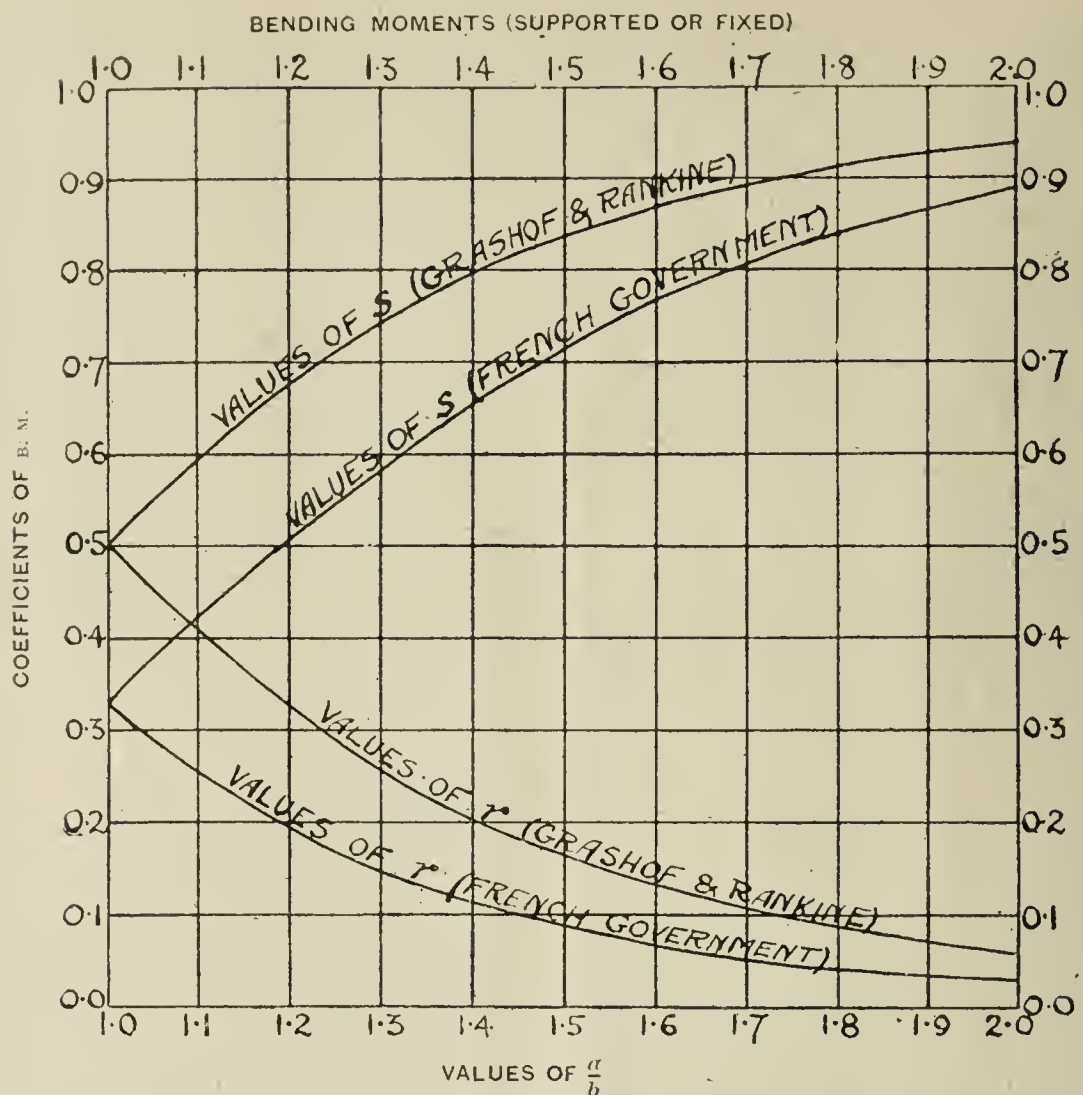
The stress on the section formed by that axis is found as before by equating this

moment to the moment of resistance of that section.

The reasoning by which we find the

When $\frac{a}{b} =$	Grashof's and Rankine's Rule		French Government Rule	
	$s = \frac{a^4}{a^4 + b^4}$	$r = \frac{b^4}{a^4 + b^4}$	$s = \frac{1}{1 + 2\frac{b^4}{a^4}}$	$r = \frac{1}{1 + 2\frac{a^4}{b^4}}$
1.0	0.50	0.50	0.33	0.33
1.5	0.83	0.16	0.71	0.09
2.0	0.94	0.05	0.89	0.03

When $\frac{a}{b} =$	Values of f according to Grashof and Rankine.		Values of f according to French Government Rule.	
	On Long Axis.	On Short Axis.	On Long Axis.	On Short Axis.
1.0	$0.375 \frac{w}{h^2}$	$0.375 \frac{w}{h^2}$	$0.250 \frac{w}{h^2}$	$0.250 \frac{w}{h^2}$
1.5	$0.416 \frac{w}{h^2}$	$0.183 \frac{w}{h^2}$	$0.361 \frac{w}{h^2}$	$0.101 \frac{w}{h^2}$
2.0	$0.352 \frac{w}{h^2}$	$0.088 \frac{w}{h^2}$	$0.333 \frac{w}{h^2}$	$0.045 \frac{w}{h^2}$



factors s and r is not entirely satisfactory, and other writers give other values. In the Instructions issued by the French Government to the Ingénieurs des Ponts et Chaussées with the Report of the Ministerial Commission du Ciment Armé, the factors adopted give a greater importance to the effects of the third and fourth supports. The values of s and r , according to that report, are also given in the table herewith.

The maximum stresses on the sections as found by the foregoing rules when the slab is supported but not fixed all round are given in the second table, w being the total load uniformly distributed over the slab, h its thickness, and f the maximum stress due to bending.

These results may be more readily compared by the diagram given above.

It is implicitly assumed in the foregoing that the strength to resist bending is the same in both directions, so that the reinforcements longitudinal and transverse should be of equal area, and at the same depth from the compressed face; they should be placed parallel to the ends and sides.

The stresses found by Bach's formula are also plotted on the diagram.

APPENDIX III.
The Moment of Inertia of Sections of
Reinforced Concrete.
By W. C. Unwin.

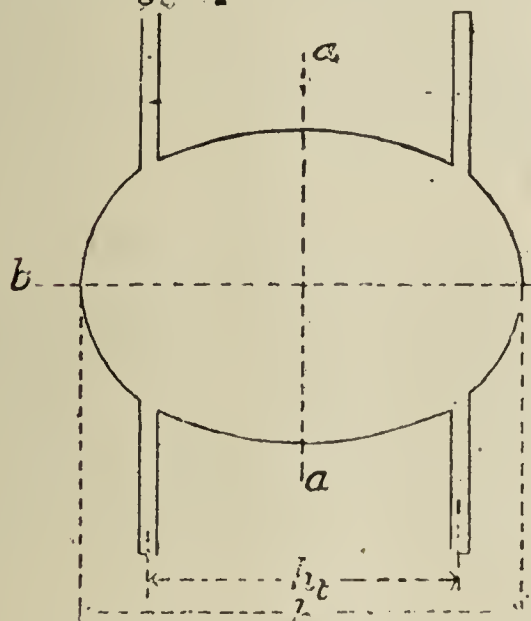
If m is the ratio E_s/E_c of the coefficients of elasticity of steel and concrete, then an area of A_t of steel is equivalent in resistance to mA_t of concrete. If A_c is the area of a section (including the area of reinforcing bars), and a the area of the reinforcing bars, then the section is equivalent to a section of area $A = A_c + (m-1)a$ of concrete only. This will be called the equivalent section.

The moment of inertia of a section about its neutral axis can always be put in the form,

$$I = nAh^2,$$

where h is the depth at right angles to the neutral axis, and n is a constant depending on the form of the section. Thus, for a rectangular section $I = \frac{1}{12} Ah^2$, and for a circular section $I = \frac{1}{16} Ah^2$.

In dealing with reinforced sections it is convenient in many cases to express the moment of inertia in terms of the equivalent area. The equivalent area is found by adding to the actual area of the section portions of a total area $(m-1)a$ at the same distance from the neutral axis as the reinforcing bars.



The figure shows a section for which b is the plane of bending, and a the neutral axis passing through the centre of gravity of the section. The reinforcing bars are supposed symmetrical to the neutral axis. The projecting parts of total area $(m-1)a$ are the concrete areas equivalent to the steel. If I_c is the moment of inertia of the section without reinforcing bars, the moment of inertia with reinforcing bars is

$$I = I_c + \frac{1}{4}(m-1)ah^2.$$

Thus, for a rectangular section

$$I = \frac{1}{12} A_c h^2 + \frac{1}{4}(m-1)ah^2,$$

and the modulus of the section is

$$Z = \frac{1}{6} A_c h + \frac{1}{2}(m-1)a \frac{h^2}{h}.$$

For a circular section

$$I = \frac{1}{16} A_c h^2 + \frac{1}{4}(m-1)ah^2,$$

and the section modulus is

$$Z = \frac{1}{8} A_c h + \frac{1}{2}(m-1)a \frac{h^2}{h}.$$

Example 1.—Rectangular Section.—Let $m=15$, $a=0.01A_c$, and $h_t=0.9h$. The equivalent area is $A=A_c+(m-1)a=A_c+14A_t=1.14A_c$.

$$I = \frac{1}{12} A_c h^2 + \frac{14 \times 0.81}{4 \times 100} A_c h^2,$$

$$= 0.1117 A_c h^2;$$

$$\text{but } A_c = 0.877A,$$

$$I = 0.098 A h^2,$$

$$Z = 0.196 A h.$$

In this case in the general expression $I = nAh^2$, $n=0.098$, when A is the equivalent section.

Example 2.—Circular Section.—Let $m=15$, $a=0.01A_c$, and $h_t=0.8h$. The area of the equivalent section is $1.14A_c$, as before.

$$I = \frac{1}{16} A_c h^2 + \frac{1}{4} \times 14 \times 0.01 A_c \times 64 h^2 = 0.0849 A_c h^2$$

$$\text{But } A_c = 0.877A.$$

$$I = 0.0745 A h^2.$$

$$Z = 0.149 A h.$$

Example 3.—Circular Section with reinforcing bars arranged in a circle.—The reinforcing bars are nearly equivalent to a ring of steel of the same total area. Let $m=15$, $a=0.01A_c$, and let the diameter of the circle of reinforcing bars be $h_t=0.8h$. The equivalent section is $A=1.14A_c$, as before.

$$I = \frac{1}{16} A_c h^2 + \frac{m-1}{8} a h_t^2$$

$$= 0.0625 A_c h^2 + 1.75 \times 0.01 A_c \times 64 h^2$$

$$= 0.0737 A_c h^2$$

$$= 0.0646 A h^2$$

$$Z = 0.1292 A h$$

It will be seen that if the value of n in the equation $I = nAh^2$ for simple circular and rectangular sections, and the reinforced sections are compared, the results are as follows:—

	Simple sections.	Reinforced sections.
Case I.	$\frac{1}{12} = 0.0833$	0.098
Case II.	$\frac{1}{16} = 0.0625$	0.0745
Case III.	$\frac{1}{18} = 0.0625$	0.0646

The differences are not very great, so that while the value of n can always be found exactly when necessary for any proportion of reinforcement, there are cases such as that of columns where the value of n does not much affect the result, and where, from the nature of the calculation, great accuracy is impossible—for which a value of n can be assumed without any practically important error.

APPENDIX IV.

Value of E_s/E_c .

By William Dunn.

In the foregoing recommendations, as in the Prussian Government and various other foreign rules, the value of E_s/E_c for concrete of the kind usually employed, of hard stone or gravel mixed 1 : 2 : 4, is put at 15.

In reality, it varies with the age of the concrete, the proportions and nature of the materials, the stress at which it is taken, &c. As determined from tests of full-sized columns of concrete, with longitudinal reinforcement only and without transverse binding, it varied from a maximum of 10 at working loads to 15 to 21 at ultimate loads. For cinder concrete of 1 : 2 : 4 or 1 : 3 : 6 it varied from about 12 at working loads to 26 to 48 at ultimate loads.

This factor E_s/E_c is employed to determine the position of the neutral axis in beams, and it is found that while a variation between 10 and 15 makes no very great difference in the result, a value of 15 fixes the position of that axis nearest to the position found by experiment in singly reinforced beams. In fact, the formula given herein for the position of the neutral axis with $E_s/E_c = 15$ gives a result which agrees well with observed values in beam tests.

As mentioned above, it does not agree so well with the tests on columns; it

gives too great an importance to the metal reinforcements, which becomes more noticeable when the percentage of reinforcement is considerable. But these tests were made on columns with longitudinal reinforcement only and without transverse binding, which latter adds greatly to the strength. This binding is explicitly required in the Prussian Government and other proposals where E_s/E_c is taken at 15; and that figure may be taken as making allowance in some degree for it.

We have no satisfactory determination of the increase in strength due to the transverse reinforcement, whether in single bindings or a continuous spiral.

In the report of the French Commission du Ciment Armé, art. 5, it is stated that where the concrete has spiral binding or transverse or oblique reinforcements, so disposed as to resist swelling under thrust, the safe loads may be increased in some measure, but not in any case to more than $\frac{1}{10}$ of the crushing strength as determined from tests on cubes of 20 cm. sides at the age of 90 days.

In the explanatory circular accompanying that report (p. 6), the value to be given to E_s/E_c is discussed, and its theoretic value is put at about 10. It is stated, however, that it is preferable to regard that coefficient as the result of experiences on pieces with longitudinal and transverse reinforcements, and not as representing the ratios found from concrete and metal separately. It is to be taken as varying from 8 when the longitudinal reinforcements have a diameter equal to $\frac{1}{10}$ of the least dimension of the piece and the bindings are spaced at a distance equal to that least dimension in the direction of the length; up to 15 when the longitudinal bars are $\frac{1}{20}$ of the least dimension and the bindings are spaced one-third of that distance apart. In both cases the bindings are to be near the outer face of the concrete.

Again, on page 4 of the circular, it is stated that it is desirable to encourage the proper use of the metal in both longitudinal and transverse directions. While an exact determination of the increase of strength due to the transverse reinforcement would be difficult, the investigations of the Commission du Ciment Armé enables it to be admitted, *faute de mieux*, that it is found by multiplying the resistance to crushing of the concrete by a coefficient

$$1 + m' \frac{v'}{v}$$

v' being the volume of the transverse or oblique reinforcement, and v the volume of the concrete, m' being a variable coefficient depending on the efficiency or the union between the longitudinal bars. When the union is made by bindings in the usual way, m' varies from 8 when these bindings are spaced at a distance equal to the least transverse dimension of the piece to 15 when spaced at one-third that dimension.

When spiral binding is used m' varies from 15 to 32, the lower value being taken when the pitch of the spiral is $\frac{2}{3}$ of the least transverse dimension, and the higher when the spacing is $\frac{1}{3}$ of that dimension under a pressure of 50 kilos. per cm^2 or $\frac{1}{8}$ under a pressure of 100 kilos. per cm^2 .

In no case should the working stress exceed $\frac{1}{10}$ of the resistance to crushing as determined on cubes, as before mentioned.

INCORPORATED.

Sherman L. Kelley of South Bend, Ind., is looking up a location for a cement plant in Arkansas.

The Monarch Cement Co. which is promoting the erection of a cement plant near Humboldt, Kan., has paid a second installment of \$1,400 on leases held by the Company, \$5,000 having been paid thereon to date; no stock has been sold so far. The plans for the plant are said to be under way.

A large cement plant is being promoted at Mapleton, Bourbon county, Kans. Options on 20,000,000 ft. of gas have been secured at Mound City, Linn county, Kans., a shallow sand district. A purchase of \$20,000 worth of 8-inch gas pipe has been made for piping the gas from the field to the site of the proposed plant.

Owing to lack of sufficient capital to carry on contracts on hand, the Rock Island Construction Co. has asked for a receiver, the original capital being \$20,000, which was increased to \$30,000; the Company has been doing about \$200,000 worth of work per year, with large outstanding accounts.

The Kansas City Portland Cement Co. expects to start up before September 1; construction has been under way during the past 18 months.

The Ash Grove Lime & Cement Co. expect to locate at Chanute, Kansas, one mile north of the town. J. C. Harden, and J. H. Barton of Ash Grove, Mo., and some 20 Springfield, Mo., people have stock in the Company.

The Iowa Portland Cement Co. of Des Moines, Ia., have purchased 100 acres of land in the Southeast portion of Des Moines from W. W. Powers for \$24,500 upon which the Company's plant is to be erected.

The Shawnee Cement Block Co., of Topeka, Kan., is manufacturing cement blocks for the Atchison, Topeka & Santa Fe Ry., which are to be tested at the railway company's Topeka yards, with the view of adopting block construction for many of its new buildings.

The Toledo Portland Cement Co., which has been in the hands of a receiver, has been sold under an order of the court, for \$11,925. Peru, Ind., stockholders, who invested \$30,000, will receive less than \$300 or \$10.00 for each \$1,000 paid in. Mrs. Bell Howard, who invested \$1,000 in the company has brought suit against the Rev. Geo. Butler from whom she purchased stock in the company, claiming that Butler induced her to part with her money by misrepresenting the facts in the case. Butler has been arrested, and will be tried in the Criminal court of Miami county, Ind.

THE BONNER PORTLAND CEMENT COMPANY.

Work has been begun on the construction of the new 1,000-barrel plant of the Bonner Portland Cement, about three-fourths of a mile east of Bonner Springs.

The property of the company embraces 361 acres of land of an extremely diverse character immediately north of the Kaw River, lying on both sides of the Union Pacific Railroad. Included in the tract are the limestone bluffs, from which the raw material will be taken with practically no stripping, and the fertile bottom lands of the Kaw Valley, which extend to the bases of the bluffs, and on which the mill building will be located.

The ledges containing the limestone rock and shale are in the neighborhood of one hundred feet (100) high.

The company owns the gas properties from which the city of Bonner Springs derives its supply of gas, and in connection with which it is possible to operate the cement plant at a nominal cost for fuel.

The water supply will be derived from a reservoir to be built near the mill.

The Freeborn Engineering and Construction Company of Kansas City, Mo., has the contract for the engineering work in connection with the construction of the mill.

The officers of the Bonner Portland Cement Company are:

W. E. Gheen, Philadelphia, Pa., president.

W. H. Caffrey, Kansas City, Mo., vice-president.

J. D. Waters, Bonner Springs, Kan., treasurer.

A. L. Cooper, Kansas City, Mo., secretary.

The general offices of the company are 405-407 Long Bldg., Kansas City, Mo.

The Ohio Cement Co., under the laws of West Virginia, capital \$4,500,000. The incorporators are as follows: Arthur E. Johnson, Frederick A. Lehman, Fred. M. Yokom, Edward Gay Wasey and Charles H. Hatch, all of Detroit, Mich.

The citizens of Valley Park, St. Louis county, in Missouri, are elated over the prospect of having a cement plant located in their town with a capital of \$2,000,000. It is to be the largest plant in the world in the eyes of the towns people with a pay-roll of 1,400 men.

The Ajax Portland Cement Company which owns 235 acres of land north of Independence, Kan., which was purchased for \$11,000 from Pres. G. T. Guernsey of the Commercial National bank of Independence, Kan. Chas. S. Gleed is said to be the leading promoter of this enterprise. The Missouri Pacific Ry. and the Santa Fe Ry. are to build sidings from main lines to the building site.

The Care of Electric Mine Locomotives in Service, by F. L. Sessions, 80 pages 10 by 8 inches, illustrated, issued by the Jeffrey Mfr. Co., Columbus, O. It covers Electrical equipment, care of locomotives, locomotive troubles, lubrication, repairs, gathering locomotives, locomotive wiring diagrams. Copies free to users of Electric locomotives.

Incorporated under the laws of New Jersey, the Occidental Portland Cement Co. Capital, \$2,000,000.

The Tulsa Portland Cement Co. of Tulsa, I. T., capital, \$2,500,000, has been incorporated; Beeks Frick, of Fort Wayne, Ind., Pres.; J. W. McCloud, Muskogee, Indian Territory, Vice-Pres.; H. C. Ashby, Secy. of Tulsa.

Cairo, Illinois, has installed cement testing apparatus. All cement to be used on city work will hereafter be tested before being passed.

The Ohio Portland Cement Co. has broken ground for its cement plant $4\frac{1}{2}$ miles east of Weleston, Ohio. The company is incorporated under a West Virginia charter; capital, \$1,500,000. The plant will have a capacity of 3,000 barrels per day. Coal lime stone and shale are found on the company's land.

DEATH NOTICE.

Mr. Joseph W. Zepperlein, vice-president of The Wm. G. Hartranft Cement Co., died on Monday, July 22nd, after a short illness at his home in Ashbourne, Pa.

INCORPORATED.

The Cement and Concrete Company of Woodward, Woodward Co., Okla., with \$10,000 capital stock; the incorporators are S. B. Laune, E. P. Burdick and A. Van Pelt.

The Diamond Portland Cement company, of Middlebranch, Ohio, increased its capital stock Thursday from \$300,000 to \$500,000. Manager H. G. Raff, of the cement company, said the additional money would be used for the improvement of the factory equipment. There will be an immediate expenditure of \$50,000 for new machinery, it is said, which will replace that which has been in use for years. With the addition of modern equipment the output of the plant will be increased from 800 to 1400 barrels a day.

The Badger Portland Cement Co. whose factory is to be located at Sturgeon Bay, Wis., is about to commence a thorough examination of its raw material in its own laboratory, which is being installed in the city of Sturgeon Bay.

The Reinforced Concrete Construction Co., of Cleveland, O., has been incorporated at Cleveland, O.; capital, \$20,000 to \$60,000.

The Atlas Portland Cement Co. shut down plant No. 5 some time ago at Ilasco, Mo., discharging several hundred employees. The company is again increasing its force.

The Newcastle Portland Cement Co. proposes to increase its capital from \$800,000 to \$1,400,000. The additional capital is to be used in the construction of a new plant.

The Great Northern Portland Cement which was placed in the hands of a receiver some six months ago, and was operated under the orders of the court, has now been shut down by the receiver the Michigan Trust Co., of Grand Rapids, Mich.

The Blue Seal Portland Cement Co., of Kansas City, Mo., have closed with the Fuller Engineering

Co. of Allentown, Pa., for the erection of a 2,500 bbl. plant.

The production of lime and cement in Ralls county, Mo., for 1906 was valued at \$3,645,274, of which \$713,000 remained unsold at the close of the year. The Atlas Portland Cement Co. works are in this county. These figures are from the sworn returns filed with the state labor bureau of Missouri.

The Continental Brick Co. and August Heman of the Heman Construction Co., both of St. Louis, are interested in a new \$2,000,000 project which is to locate in the vicinity of St. Louis.

The Marquette Cement Co. has increased the wages of its employees 10 per cent.

CONCRETE STEEL PAVING.

Concrete steel pavements are being laid in Chicago. Ten inches of cinder foundation is placed upon the roadway and flooded for a week after which it is tamped or rolled, the same as in building a macadam road. A concrete curb is then constructed, and the concrete deposited on the roadway proper and worked to grade, with a crown in the center for drainage. After the finishing coat is completed, the surface is grooved to resemble brick pavement street; these grooves afford a better foothold for teams than if left smooth. We believe that this style of pavement will become popular when its merits are better known.

The Cement Products Company, of Minneapolis, Minn., and Okeene, with \$250,000 capital stock. The incorporators are C. F. Haglin, H. N. Lighton and E. G. Potter of Minneapolis; H. H. Dohe and H. E. Wilson, of Okeene.

Cement is finding a slow market in many parts of the country at present.

The Sandusky Portland Cement Company, which is building a railway line from Syracuse to Milford, Ind., has petitioned the county commissioners of Kosciusko county for permission to use 16 feet of the public highway from the company's

plant to its railway line. The original intention was to use the right of way and tracks of an electric line known as the Wawasee Route, which having passed into the hands of a receiver, compels the company to build its own track over this section.

William J. Hilt, a cement contractor at Janesville, Wis., has been appointed official sidewalk builder by the city council of that city.

Glenwood, Ind., is preparing to let contracts for two miles of cement sidewalk in the near future.

The Chamber of Commerce of Colorado City, Col., is offering inducements for its location of a Portland cement plant at that place.

The county commissioners of Pueblo county, Colorado, will hereafter construct all county bridges of concrete.

The American Cement Plaster Co. which operates two mills at Marysville, Kan., has laid off the night force at Mill No. 1 and closed down mill No. 2, on account of lack of orders. The day force of mill No. 1 being able to fill all orders now in sight.

Lonoke, Lonoke Co., Arkansas, has let contracts for 100 blocks of cement sidewalks. This season, 90 additional blocks will be let before the close of the season. The entire cost of cement walks to be laid this year will cost about \$40,000. The Sumption Paving Co., of Lawrence Kan., and the Brinkley Paving Co., of Brinkley, Monroe county, Ark., are the contractors for the work now under way, the lowest bid being 12½ cents per square foot.

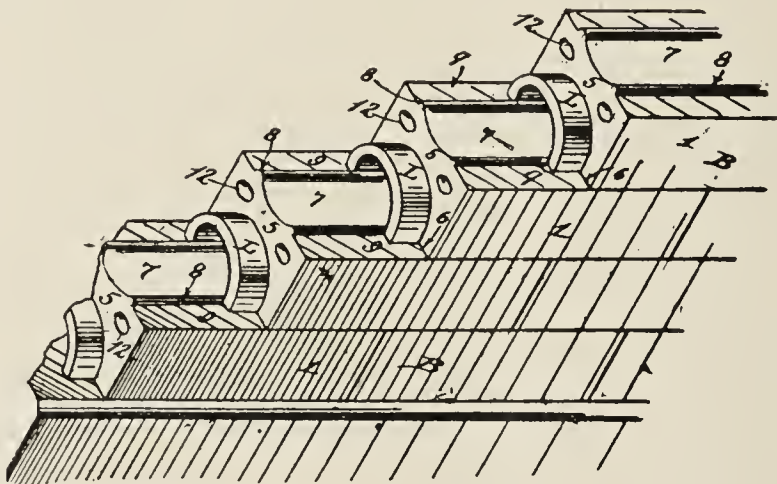
The city of Toledo, O., requires and will build only cement watering troughs hereafter on public streets.

The Southwestern States Portland Cement Co., Cowham-McCourtie Syndicate, which is to erect a cement plant four miles west of Dallas, Texas, has its drilling machinery on the ground. The ground will be surveyed and staked for the buildings, for a 3,500 barrel plant. Offices are to be opened on Main St., Dallas.

U. S. PATENTS RELATING TO CEMENT AND CONCRETE.

858,988. Building-Block. John L. Judge, New York, N. Y. Filed Feb. 25, 1907. Serial No. 359,270.

1. The combination of a building block of the character designated, formed one one side with a groove extending through it from one end face to the other with parallel bearing surfaces on each side of said groove, said block being formed on the opposite side with parallel bearing surfaces of greater width than those on the side of the block first mentioned, and with parallel dam shoulders bounding the inner edges of said broader bearing surfaces, and a lap tile fitting the groove in the block, said lap-tile being of a thickness approximately equal (less the thickness of the mortar seal) to the difference in width between said parallel bearing surfaces on the opposite sides of the block, for the purpose described.



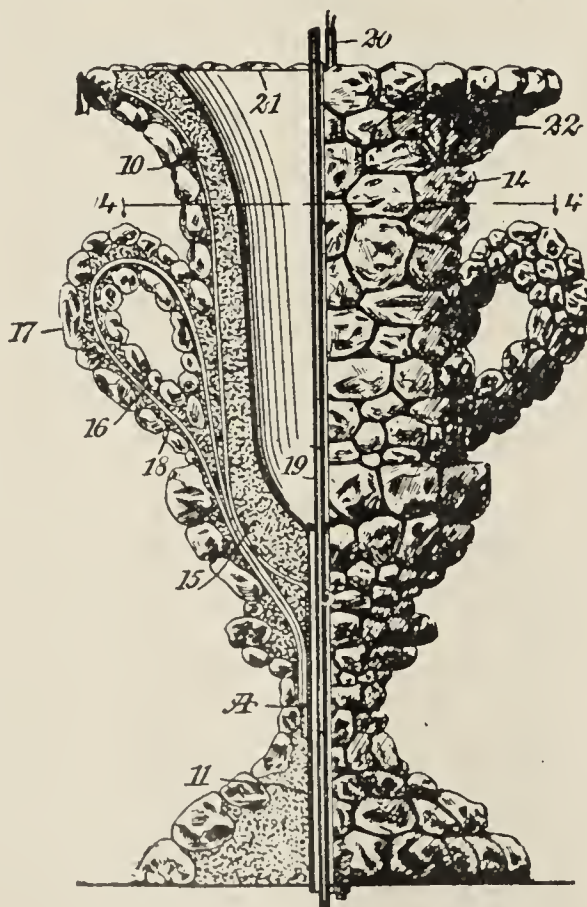
No. 1.

859,120. Art of Forming Molds. Charles R. Schmidt, Baltimore, Md. Filed Dec. 11, 1906. Serial No. 347,393.

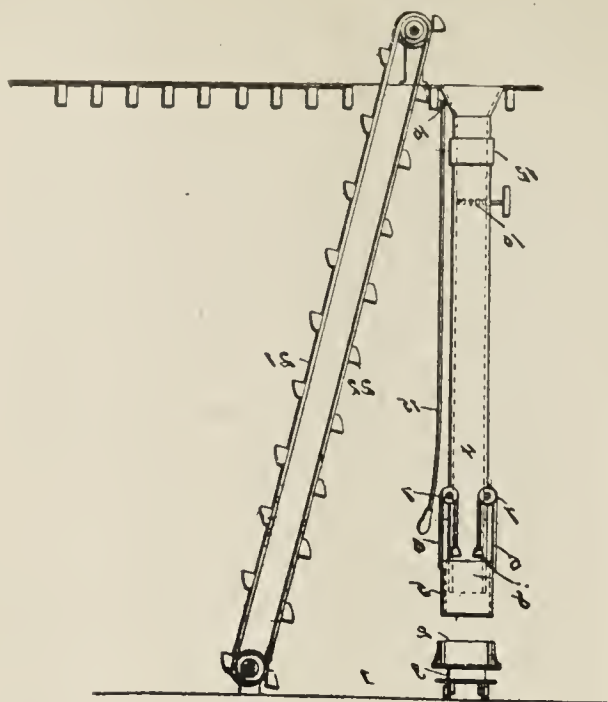
1. The improvement in the art of forming molds, which consists in dropping the molding material into the mold in the form of a shower of soft pellets, from such height as will cause the pellets to be compressed by gravity alone into a compact mass of practically uniform density.

3. The method of continuously mixing and molding concrete for the production of building blocks, consisting in continuously conveying the ingredients of the mixture in automatically regulated proportions to a mixing machine, mixing the ingredients therein, delivering the mixture to a vertical chute, measuring a charge for a mold therein, subdividing the measured mass into pellets, dropping the divided charge into a mold box and concentrating and compacting the pellets by gravity into a compact mass.

3. A vase, urn or the like provided with a framework consisting of



No. 3.



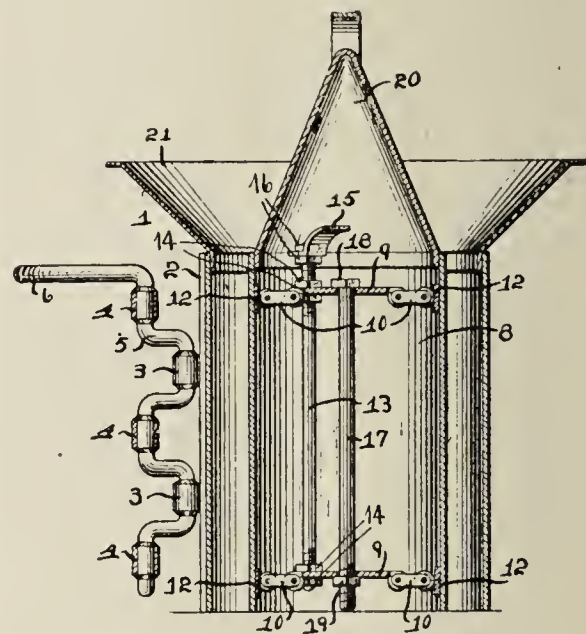
No. 2.

858,939. Hollow Stone Structure. Andrew Angeloro, New York, N. Y. Filed Feb 1, 1907. Serial No. 355,318.

a central column having longitudinal slits therein forming a series of leaves, which leaves are bent outward from the said column and are given any desired shapes, longitudinal and vertical wires supported by the said leaves, a bed of cement likewise supported by the said column and the said leaves, and stones located at the outside of the structure, lying one in engagement with the other, partially supported by the said wire network and partially supported by the said bed of cement.

858,638. Tile-Mold. John J. Swenson, Roswell, N. Mex. Ter. Filed Sept. 17, 1906. Serial No. 334,909.

1. In a tile mold, an exterior shell and a collapsible core, 'said' core comprising a cylindrical sheet of metal, a bolt axially arranged therein having a nut adjustably mounted

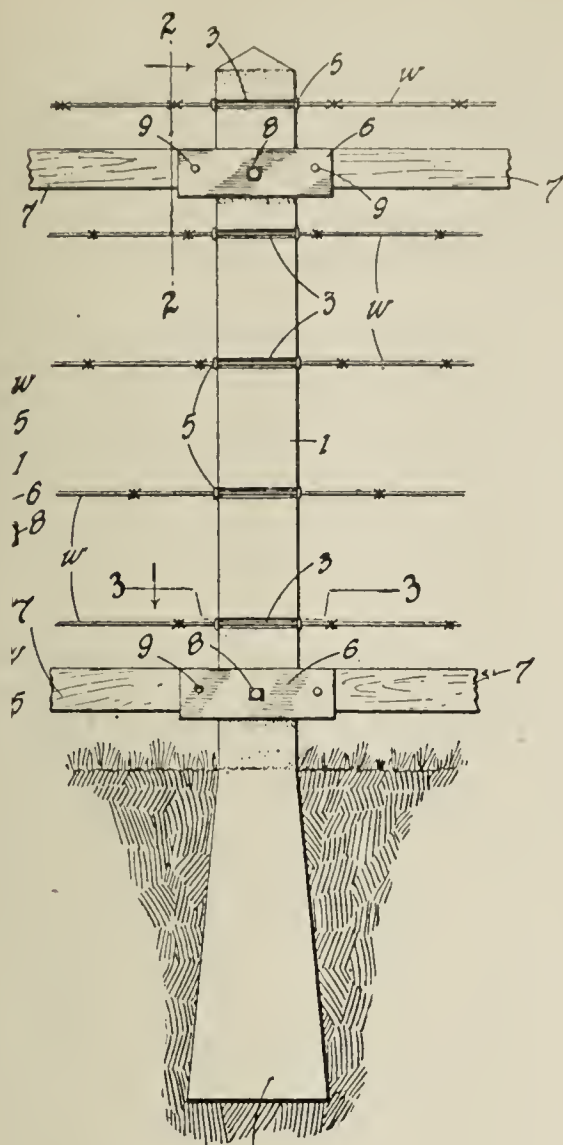


No. 4.

on its lower end, two disks loosely mounted on the bolt and rigidly spaced apart, toggles secured to the edges of the disks and to the interior of the core, and a handle at the upper end of the core.

859,239. Fence. James R. McFall, St. Louis, Mo. Filed Oct. 22, 1906. Serial No. 340,066.

1. A fence comprising posts provided with a series of transverse grooves encompassing the body of each post, wire sections passed through said grooves, anchors comprising bands of wire wrapped around the grooves and having their ends looped about the wire sections on each side of the post, adjustable brackets mounted near the tops and bottoms of the posts and having terminal open pockets extending on each side of the post, and rails disposed between the successive posts and having their ends supported in said pockets.



No. 5.

854,856. Apparatus for Manufacturing Concrete Blocks. George B. Tyler, Hastings, Nebr., assignor of one-half to William R. Waters, Hastings, Nebr. Filed Aug. 25, 1906. Serial No. 331,958.

Claim.—In apparatus for manufacturing concrete blocks, a casing comprising wooden side walls provided on their longitudinal edges and corners with stiff binding strips adapted to prevent bending of said walls and having on their inner faces linings of material impervious to moisture which are extended under said stiffening strips and se-

cured in place thereby, end members disposed between said side walls, and clamping devices for securing the side walls and end members in relation.

CONCRETE MACHINERY.

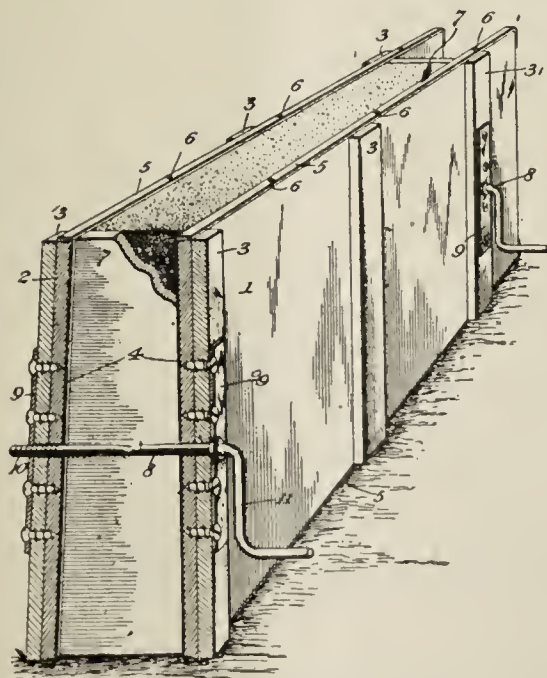
A spur to the use of concrete for building is afforded by the ownership of a concrete machine outfit. We have in our possession a number of illustrations of highly presentable architectural effects produced by the use of outfits which secure the entire elimination of monotony in wall construction, to an extent that makes a building of concrete blocks as striking as natural stone. In cases where one wishes to do his own construction, or when skilled labor is not available and ordinary hands are alone to be had, substantial, pleasing, and economic results are also within our knowledge. In the faces and sizes of blocks, a wide range of variety is reached. The outfits are simple, rapid, mechanically perfect and will produce designs with considerable labor saving. The machines are positive in their lever action for the removal of cores, are built to permit hand or power tamping and arranged to obtain fractional-sized blocks in every inch dimension within the capacity of the apparatus and with all proper marginal effect. The type under consideration is manufactured by the Ideal Concrete Machine Company, of South Bend, Ind., and its portable and convenient devices make blocks down face. This firm owns and controls the fundamental patent on the combination down face, horizontal core, hollow block machines, as well as on valuable accessories and improvements. The machine is easily handled and it is possible to produce a block with a face richer in material than the balance of the concrete, thereby making it closer grained and more impervious to moisture. This is accomplished with the least possible cost to get such results. In other words, if the whole block had to be made of the same rich mixture of cement, the cost would be prohibitive, because of the percentage of cement used. The system of facing named permits the balance of the block to be made of coarser material, costing less, yet securing the maximum strength at about one-third of the expense. It may be easily seen that a face richer in appearance, more definite in design, and greater in variety of artistic refinements can be obtained, and that the blocks make a dry, sanitary house, warm

in winter and cool in summer. The outfits run from No. 1 to 6, and range in sizes from 8x8x16-inch machine complete to 8x12x24. The technical portion of the company's catalogue gives the details of the equipment and work performed by each outfit and also complete illustrations of the machines and separate rendition of parts. This comprehensive issue is invaluable for the purpose of giving an exposition of the numerous advantages of the machine. It shows how hollow blocks are laid in a wall; the cost data of hollow blocks; how to find the number of blocks required for a house of any dimensions; how to face blocks on the machine; gives the color processes for cement and concrete work; describes mixers and molds, and pictures with delightful clearness numerous specimens of block forms and facings and finished structures. A number of illustrations depict the operations of the machine by handlers, taken from life; and the methods of work show the results are obtained with ease and mechanical deliberation. The salient advantages of the down-face method show that the pioneer features in block machines have been cleared away and that the device is able to mold cement into natural aspects and on structural and durable lines. In doing these, it helps concrete to make at least a full step forward in its position of being among the leading causes of the country's development. The firm bears the title of Ideal Concrete Machinery Company, Limited, London, Canada.—Scientific American.

Homer C. Millen is negotiating for the purchase of the uncompleted White Portland Cement plant at Chelsea, Mich. Mr. Millen was associated with W. J. White in the development of the property. The company went into the hands of the receiver and was sold at a judicial sale and repurchased by the W. J. White Co.

The American Concrete Pole Co. which was organized at Richmond, Ind., with a capital of \$10,000, is to commence business in August.

J. A. Williamson of Paris, Ill., who owns patents on curbs and gutter construction, is about to commence suit against Parrish, Heilig and Menke, contractors, for infringement of his patents on 13,000 lineal feet of curbs and gutter work finished in Paris. There are very few valid patents in this country at this date.



No. 6.

Nine large English iron and steel manufacturing companies with a capital of \$130,000,000 have formed a combine or trust. This trust has now absorbed thirty-six other independent iron and steel plants, which will give the trust control of 90 per cent. of the steel produced in Great Britain. The object of the combine is to meet American and German competition as well as to dominate the steel and iron trade of the world.

PRODUCTION OF COAL IN 1906.

The United States geological survey statistics show that 414,039,580 short tons of coal were mined in the United States in 1906 valued at \$512,610,744, being an increase of 21,120,240 tons over the production of 1905, and \$35,853,781 in value. Pennsylvania leads with 71,282,411 tons of anthracite valued at \$131,917,694, and 129,263,675 tons of bituminous valued at \$130,265,241. West Virginia stands next to Pennsylvania; Illinois being third in the list.

CONCRETE TELEGRAPH POLES.

The Pennsylvania railway has erected 53 reinforced concrete telegraph poles, near Mapes, ten miles east of Fort Wayne, Ind., which, after one year's service have been pronounced satisfactory in every respect.

A new substance called Galalith is now produced from milk. It can be made into blocks and other shapes for the construction of buildings, and is said to be as strong and durable as granite, and is fire-proof.

CEMENT BOOKS.

Reinforced Concrete by Charles F. Marsh and William Dunn. \$7.50.

Concrete and Reinforced Concrete Construction, by Homer A. Reid. \$5.00.

Practical Cement Testing

by

W. Purves Taylor. \$3.00.

Address CEMENT & ENGINEERING NEWS, 22 Fifth Ave., Chi.

The United States Steel corporation has loaned out \$75,000,000 in Wall St. Orders on its books for 1908 exceed that of any previous year on advance orders. This is a healthy sign, and indicates a continuation of our present prosperity for another year.

The Bonner Portland Cement company has awarded the contract for the engineering on the new plant at Bonner Springs, Kansas, to the Freeborn Engineering & Construction company of Kansas City, Mo.

Work on the construction is already under way.

The Freeborn Engineering Construction Co. have changed the office address to 605-615 Scarritt Bldg., Kansas City, Mo.

The Blue Seal Portland Cement company of Kansas City, Mo., are to erect immediately a mill with a capacity of 2,500 barrels per day at Courtney, Jackson Co., Mo., 11 miles east of Kansas City, Mo. and directly on the Santa Fe railroad. Oil or coal will be used for fuel. The contract for the building of this plant has been let to the Fuller Engineering company of Allentown, Pa.

The Continental Portland Cement Co. of St. Louis, Mo., has been incorporated. Capital, \$3,500,000. David M. Marks, Pres.; Dwight Harrison, Secy. A plant is to be built a short distance from St. Louis in St. Louis county, Mo.

Tokyo, Japan, is to have an underground railway extending across the city for a distance of twelve miles at an estimated cost of \$7,500,000. A commission for the project being in the hands of a Belgian syndicate.

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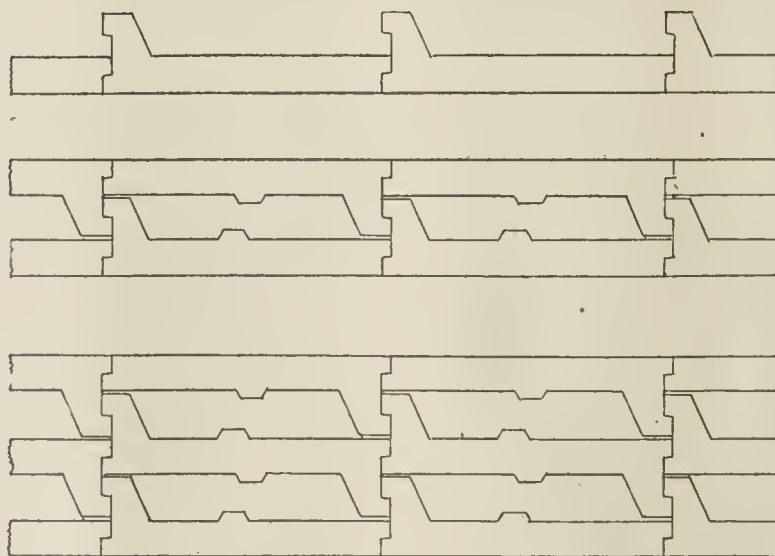
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The patterns include cornice, belt courses, porch columns, chimney blocks with numerous face plates. This system can be used in the form of a single shell interlocking with the wooden framing producing the most economical veneered concrete facing in existence. Address,

Box 74, care of Cement & Engineering News

FOR SALE.

Patents of American Hydraulic Stone Co. for two piece hollow box system and of the Perfection Machine for use in columns, etc., for the City and County of St. Louis, together with machine forms and all other implements necessary for immediate commencement of the work. Address W. H. Swift, 905 Chemical Building, St. Louis.

SITUATION WANTED.

Chemical Engineering Graduate, '07, age 25 yrs., wishes position as chemist or assistant superintendent in cement plant. Have had four years' experience as draftsman previous to college training. Address X. V. L., care Cement & Engineering News.

FOR SALE.

No. 3 McKelvey (continuous) Concrete Mixer, cheap; mounted on truck with steam engine and boiler all complete; in excellent order. Address H. C. Hunsberger, 918 Royal Insurance Bldg., Chicago, Ill.

CONSTRUCTION ENGINEER with several years' experience in designing, erecting and remodelling cement factories, desires position with newly organized cement company. Address Concrete & Steel, care Cement & Eng. News.

WANTED.

MILLWRIGHT, first class experienced man for cement plant, permanent position, apply with references and state wages expected. Box F, Belleville, Ont.

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Chemist, experience in chemical and physical end of the business of several years. Now employed. Reasons for change given. Address "Competent," care Cement & Engineering News.

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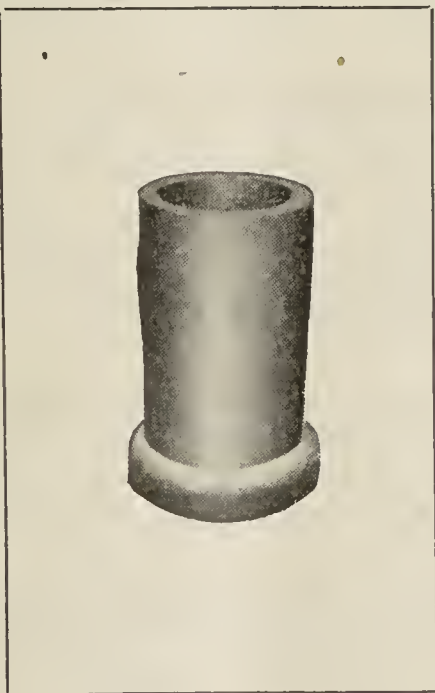
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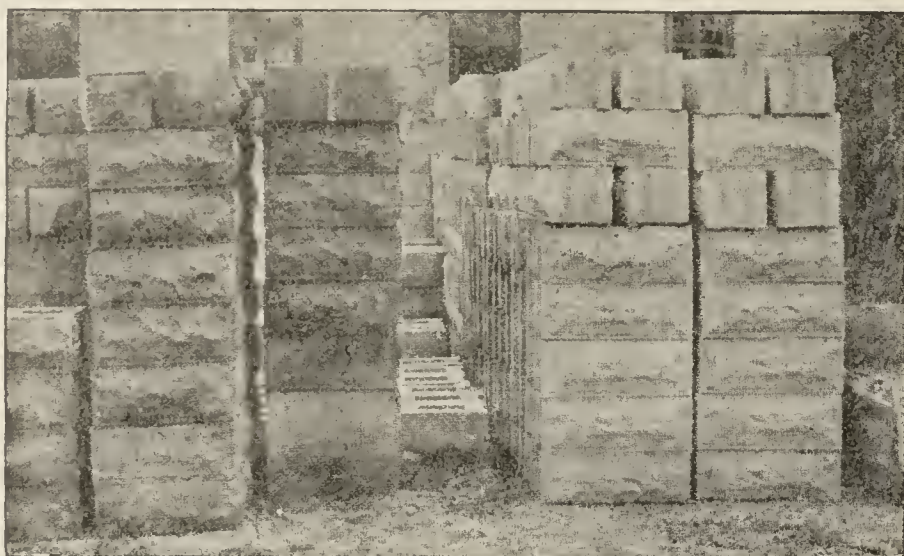
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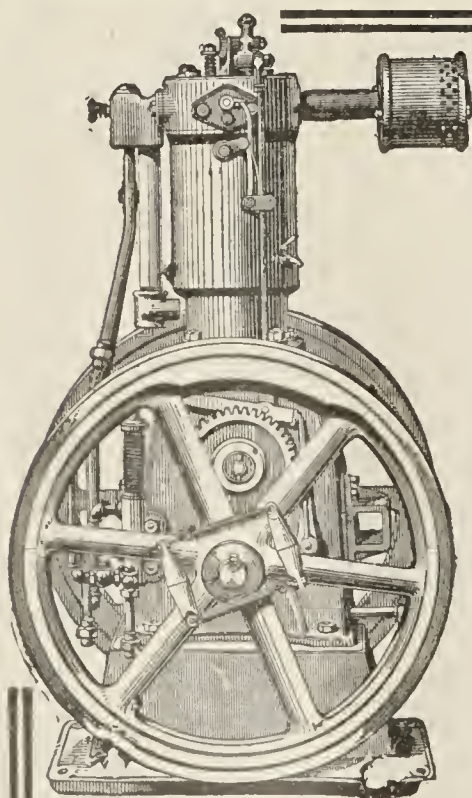
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Illustrated. Covers in detail. Materials, cement and aggregates. Process of manufacture to obtain the best results. Waterproofing mixtures. Classification of machines. Hand and machine tamping. Crushing strength. Handling and storing. Table of mixtures. Strength with sand and gravel, or limestone screenings. Cost of materials. Fine sand mixtures. Absorption, porosity and permeability. Color mixtures. Estimates, labor and materials. Comparative cost of brick and concrete blocks laid up in walls. Reproduction of concrete in various patterns, shapes and designs.

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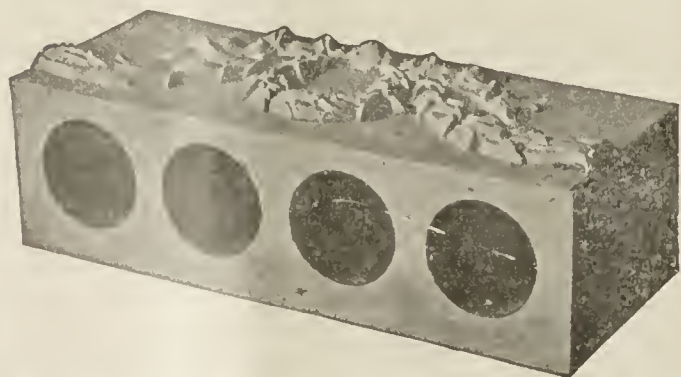
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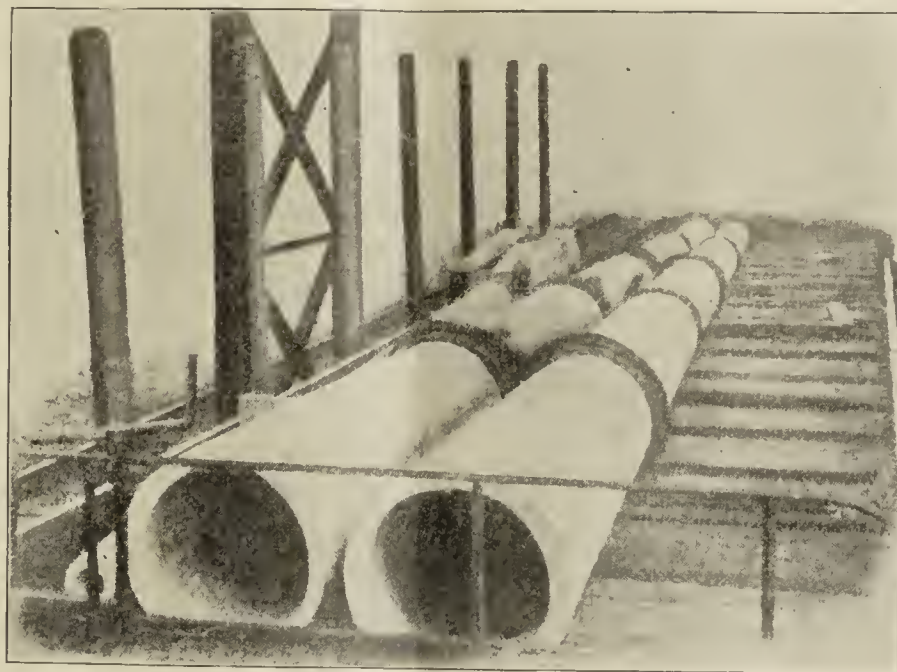


Fig. 1.

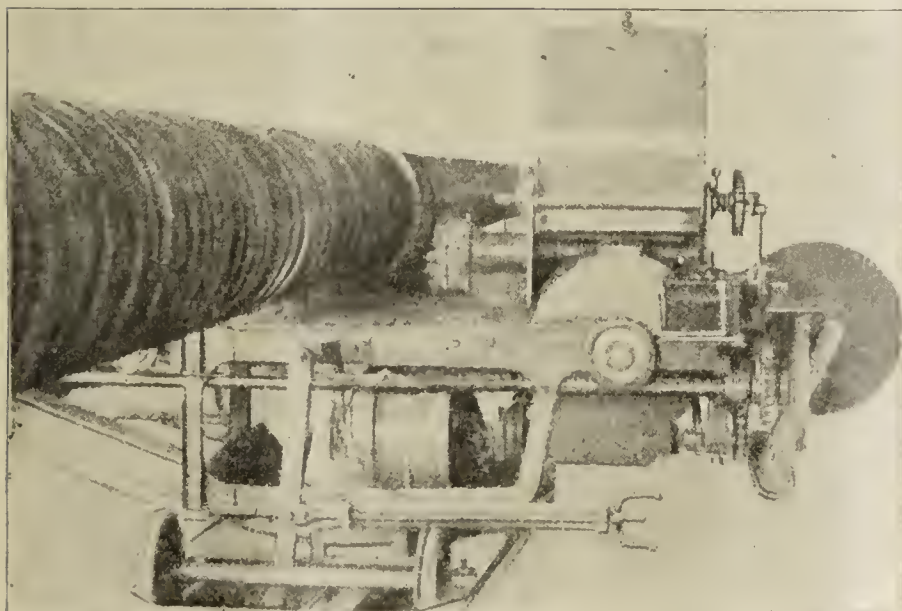


Fig. 2.

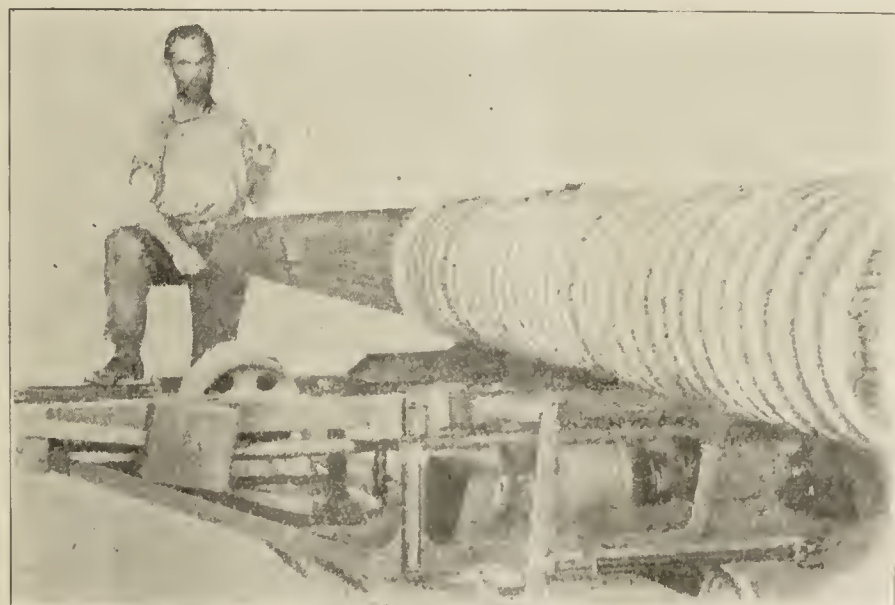


Fig. 3.

SIEGWART HOLLOW REINFORCED CONCRETE MAST.

Fig. 1. Finished Mast Loaded on Cars. Fig. 2 & 3. Covering the Mast with Concrete by Machinery.

See Page 180 for Description.

CEMENT AND ENGINEERING NEWS

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CHICAGO, AUGUST, 1907.

CORRESPONDENCE.

We solicit correspondence on all matters of general interest to the cement trade in all its branches. Engineering notes, public improvements, and facts and opinions drawn from practical experiments will be welcome.

SAFE REINFORCED CONCRETE CONSTRUCTION.

We have repeatedly directed attention to the precautions that must be taken to insure safe and reliable Reinforced Concrete Construction.

1. That the material entering into the concrete is sound and reliable.
2. That the mixture is properly proportioned.
3. That the forms in which the concrete is molded are of sufficient strength and properly supported.
3. That the forms in which the concrete is molded are of sufficient strength and properly supported.
4. That the specified amount of steel is suitably placed in each structural member depending upon the load which such member is to carry.
5. That no form be struck or supports be removed only on the written order of the superintendent in charge, that a copy of any and all such orders be filed with the architect, in order to fix the responsibility for slip shod supervision.
6. Sixteen days should be the minimum time within which forms should be struck and then only after thorough examination.
7. That only competent and experienced supervision should be permitted on reinforced concrete work.
8. That all steel reinforcing members be laid in 1 to 2 cement mortar.

The recent failure of a reinforced concrete warehouse building at Philadelphia was due, not to any fault in construction, but in striking the forms 5½ days after the concrete had been placed.

The failures in reinforced concrete, in most cases, have been traced to incompetent supervision and not to the materials entering into this class of constructions.

HOLLOW REINFORCED CONCRETE MAST.

Hans Siegwart, architect, of Luzern, Switzerland, has placed a hollow reinforced concrete mast on the market. The extra strong corner mast is about 39 feet long, reinforced with round iron laid on a collapsible core, and wound with numerous turns of wire from end to end. The mast rests on a carriage and is made to revolve. One end of a belt is fastened to the mast at its largest diameter. This belt is wound spirally around the mast, passing under a hopper charged with cement mortar. A predetermined layer of mortar is carried forward and laid onto the reinforcing metal and compressed against the skeleton mast under the tension of the belt. The carriage moves forward to enable the belt to form one spiral turn on the mast, when the mast is completely covered from one end to the other in one continuous operation. After this the mast is permitted to set and harden, when the cone is reduced in size and withdrawn, which leaves the reinforced concrete shell which is about one inch thick at the base increasing to two inches at the top. The mast is set into the ground 4 ft., 10 inches and surrounded by concrete.

HAND BOOK OF REINFORCED CONCRETE CONSTRUCTION.

"Eisenbetonbau," in the German language, by Dr. F. Von Emperger, 311 pages 7¼ by 10½, with 503 illustrations. Price 16 marks, Wm. Ernst & Sohn, Berlin, Germany, publishers. Part two of this work covers reinforced concrete tanks, pipes, open cut sewers, culverts, aqueducts, bridges, poles and masts, tunnel and subway lining shown in reduced working drawings. The beauty and utility of this work lies in the fact that the author and contractor have united to make the work practical, as several of the best designers and erecting contractors have embodied their experience in the pages of this work. Much of the data is therefore drawn from actual construction work. This work should be in the hands of all persons doing reinforced concrete work as it covers the entire field of modern concrete construction. Copies of this work can be consulted at the office of the Cement and Engineering News.

CEMENT MANUFACTURERS MEETING.

The next Quarterly Meeting of the Association of American Portland Cement Manufacturers will be held at the Marlborough-Blenheim Hotel, Atlantic City, N. J., on September 9th, 10th and 11th. Executive Committee meeting on the evening of the 9th; Business Meeting of the Association on the 10th, and reading of papers on the 11th.

At the meeting on the 11th three papers have already been arranged for, namely:

"Illustrated Talk on the Work of the Structural Materials' Testing Laboratories at St. Louis," by Richard L. Humphrey.

"What the Cement Industry Needs in the Control and Regulation of the Cement Block Trade," by E. S. Larned.

"Electrical Equipment in Cement Plants," by J. B. Porter, of the General Electric Co., Philadelphia, Pa.

Members are urged to make arrangements for rooms at once. Please inform the Association office as soon as possible of the number and names of gentlemen who will represent your company.

We are advised by the Sandusky Portland Cement Co., of Sandusky, O., that their Medusa Water-proof Compound is being used for waterproofing the concrete construction in the following jobs:

Metallic Casket Co., addition to plant at Springfield, O.

M. J. Brandenstein Bldg., San Francisco, Cal.

Joseph Brandenstein Bldg., San Francisco, Cal.

Delger Building, San Francisco, Cal.

Mechanics & West bank Bldgs., San Francisco, Cal.

Proctor & Gamble factory, Staten Island, N. Y.

Pugh Printing Co., power bldg., Cincinnati, O.

Bostwick-Braun warehouse at Toledo, O.

Packard Motor Car Co., new building, New York City.

The cement company have been twice compelled to double the capacity of their water-proof plant and are now crowded with orders.

The U. S. Government Engineers are now construction a deep water channel in New York harbor 7 miles long, 1,000 feet wide and 40 feet deep, being a cut through the outer bar to the Narrows. The work was commenced in 1901 and has cost \$2,500,000 to date. The cut is to be widened to 2,000 feet with a uniform depth at low water and will cost \$4,000,000 when completed.

REINFORCED CONCRETE.

Adopted by Portland and Seattle Railroad for Vancouver Viaduct and Klickitat Bridge.

That the Portland and Seattle Railroad is making use of the best there is in modern railroad construction is shown in their adoption of reinforced concrete for bridge work where that material can be used to advantage. Notable examples of this will be the viaduct in Vancouver and the bridge over the Klickitat River. The latter will be a single arch of a span of 160 feet and will present the appearance shown in the cut herewith, as viewed from the Columbia River. Being architecturally beautiful this will form a notable feature of the scenic value of that stream. The Wallace-Coates Engineering Company of Chicago and Portland, specialists in this class of construction, have been retained by the P. & S. R. R. to draw plans and specifications and supervise the construction of this work. They have also been retained by the city of Spokane in the same capacity to replace steel bridges in that city with others of reinforced concrete.

Buildings of this material are not unknown in the Northwest but it is believed these will be the first bridges to be built of reinforced concrete in this section. They have advantages over steel or wood in being unaffected by weather, growing stronger with age, requiring no painting or repairs and consequently doing away with maintenance charges. They are also of the greatest stability as is the case with all masonry work, and not subject to the great vibration noticed in steel bridges under passing trains. Steel or wood highway bridges are subjected to racking stresses caused by the rhythmical impact of the hoofs of horses trotting or troops marching in unison. For this reason it is a common thing to find signs at either end of such bridges commanding drivers to slow down to a walk under penalty of fine. The officer in charge of troops commands them to break step. Otherwise these stresses may become so great as to cause the collapse of the structure under the passing load. A considerable amount of time is lost by drivers frequently crossing such bridges. Reinforced concrete bridges are not thus affected because they become practically one piece of stone and consequently "as firm as a rock."

This form of bridge construction is not at all new, having been in use in Europe for over a generation. It



has become common in the Eastern and Middle States both for railway and highway work. Notable examples are to be found over the Piney Branch in Washington, D. C., and near Belvidere, Ill. The latter was built under the Strauss patents for the Elgin-Belvidere Railroad and consists of four low arches placed without wood form work or centering, this feature being embodied in the Strauss system.

It is expected that reinforced concrete bridges will eventually replace steel and wood in the majority of cases because of its unquestioned advantages. Besides those stated above it is impossible to burn these bridges and since they are usually founded on bed rock, and are themselves essentially rock reinforced with steel rods, they are "part of the geology" and safely withstand floods that would carry away structures built of other material. The weight and monolithic character of the concrete aid the reinforcement greatly to this end.

The features of reinforced concrete bridges make them the safest for travelers to cross and the engineers of the P. & S. Railroad are to be highly commended for their selection of this material.

Because of the characteristics of reinforced concrete the installation of dams built of the material is considered by advanced engineers to be the most desirable method of impounding water for irrigation, power and other purposes. The Reclamation Service is using it very largely.

With the advantages of reinforced concrete buildings we are made acquainted by examples in the principle cities of Oregon and Washington. One of the most recent is the Proudfoot Building in Portland, Oregon. This also was designed by the Wallace-Coates Company. These buildings are of the most durable nature and are so thoroughly fireproof as to make fire

insurance unnecessary. Their general adoption in Europe is a prime factor in the infrequency of destructive fires in the large cities there and explain the slight cost of maintenance of fire departments. The more we get in the Northwest the more effectively the cities will invite investment of outside capital in our real estate since safety from fire is more surely gained.

Another feature of this material not to be overlooked was brought forward in the recent earthquake, when it was demonstrated beyond question to be quite unaffected by the shocks when properly designed and constructed. It may be stated that these last words are the keynote of all reinforced concrete construction. Its erection demands the best engineering skill, thoroughly experienced in this class of work, and its use should not be undertaken without expert guidance.

ARKANSAS DIAMOND FIELD.

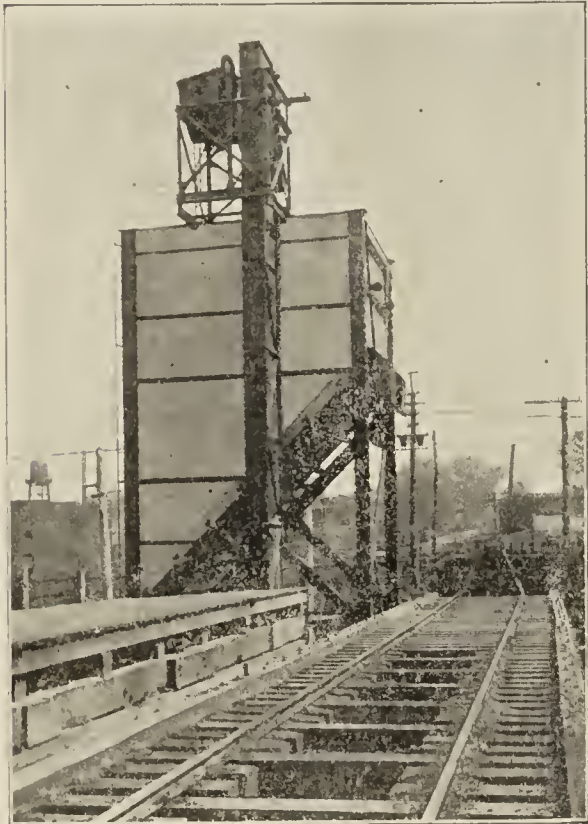
Diamonds have been discovered in Arkansas. One hundred and thirty diamonds so far taken from the surface, indicate that they exist in large quantities. Several of these stones are water white and weigh as much as six and one-half carats, while others are yellow and brown.

The deposit in which these diamonds are found resembles the famous "blue grounds" of the Kimberly South Africa diamond fields and there is a possibility of the Arkansas deposits being equally rich in precious stones.

Prof. Wm. Freeman Myrick Goss of Purdue University, has accepted the position of dean of the College of Engineering of the University of Illinois. He will take up his work at the University of Illinois on September first.

CONCRETE ASH BINS.

The accompanying cuts illustrate a reinforced concrete ash bin and elevator which were recently installed by The Jeffrey Mfg. Co. of Columbus, Ohio, at the power plant of the Knoxville Railway & Light Co. at Knoxville, Tenn., for handling



ling the accumulation of ashes at their power plant.

At this plant the ashes are handled in small push carts from boiler house to elevator, where they are dumped into receiving hopper and elevated by means of an elevator of the chain and bucket type to bin. This bin holds approximately 30 tons of ashes and delivers its contents to railroad cars, on switch



running alongside of bin, thru bin gates and aprons.

The elevator, which is 46 centers, has a capacity of 12 tons per hour and is operated by a 5 H. P. motor connected to head shaft of elevator. The elevator being encased the entire length and deliver-

ing through a steel spout to bin, makes the equipment practically dust tight.

Any parties particularly interested in this class of equipment may receive full information concerning same by writing direct to The Jeffrey Mfg. Co. of Columbus, Ohio, builders of power plant equipments.

CANADIAN CEMENT PRODUCTION.

The manufacture of cement in Canada dates from the year 1891, when operations were begun in a very small way at Marlbank and Shallow Lake, both in the province of Ontario. The first year's output was 2,033 bbls., which is only a little more than the daily production of one of the modern plants. In 1892 the output was 20,247 bbls. and 31,924 bbls. in 1893.

The next ten years in the cement industry of Canada witnessed an increase of 50 per cent, each year over the production of the preceding year. Four plants were in operation in 1901, and now there are nineteen.

In 1906 there were fifteen plants in operation, with a total daily capacity of about 10,500 bbl., and according to the published figures of the Canadian Geological Survey, during the year 2,152,562 bbls. of Canadian cement were made, which represent an increase of 610,994 bbls. or 39.6 per cent. over the production of 1905.

Very little cement is exported from Canada. The consumption is due to the use each year of better and more improved machinery and equipment. An excellent example of a cement plant whose equipment will, when completely installed be among the best in Canada, is that of the Western Canada Cement and Coal Company, which, some time ago, purchased through Allis-Chalmers-Bullock, Ltd., of Montreal, three Allis-Chalmers 1,000 K. W. Steam Turbine generator units for use on the company's properties located fifty-seven miles west of Calgary, Canada on the Canadian Pacific Ry.

The new units, which are now being erected, will generate current of 60 cycles, 3 phase, at 600 volts, and the coal to be used in their operation will be taken from the bank-head mines of the Canadian Pacific Railway and delivered at the mills.

The adoption of electrical drive for the operation of these cement mills, whose current will be derived from a steam turbine power plant which will rank among the foremost installed for industrial pur-

poses, is a frank acknowledgement of the well recognized superiority of electrical drive over mechanical forms in the cement making industry.

The current generated from the turbo-unit will be devoted entirely to power purposes; the lighting load consisting of some forty arc and four hundred incandescent lamps, will be carried by the exciters, also of Allis-Chalmers build, in addition to their work of exciting the turbo-alternators.

The equipment built by Allis-Chalmers Company for the Western Canada Cement and Coal Company is not confined, however, to the two turbines described. Allis-Chalmers Cement making machinery comprising a $7\frac{1}{2}$ Style "K" and $\frac{1}{4}$ Style "K" Gates breaker and sixteen tubo mills are also in use there.

More than half the cement plants of Canada include in their equipment Allis-Chalmers Cement making machinery of approved modern types.

SUGAR FROM CORN STALKS.

Prof. Francis L. Stewart of Murfreesville, Pa., has invented a process for extracting sugar from corn stalks. At a certain stage in the growth of corn the ear is stripped from the stalk, after which the sugar content is increased in the stalk. A company has been organized to build a plant in California to cost \$350,000 which will produce sugar at half the cost of beet or sugar cane sugar.

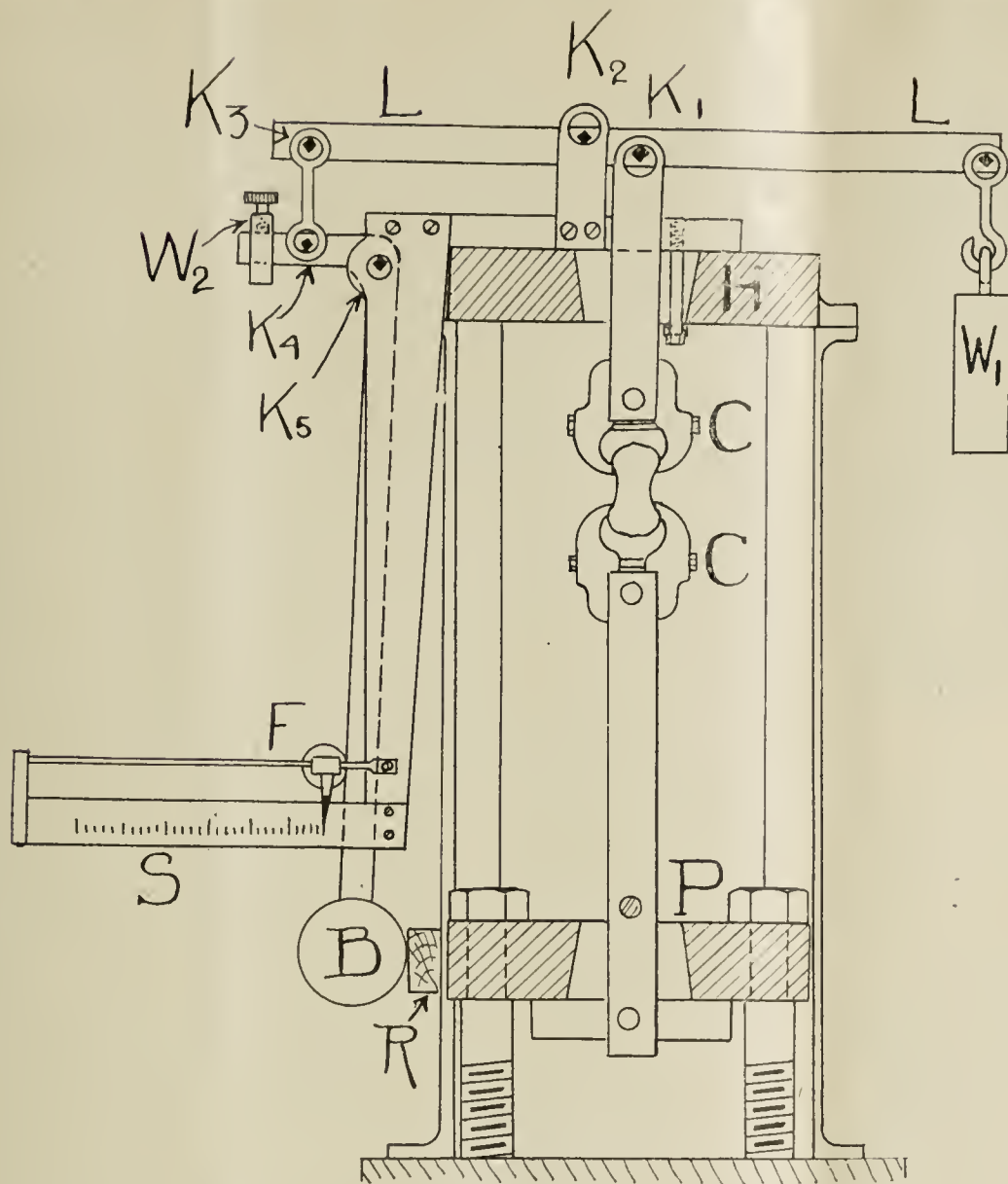
A BRIQUETTE TESTING MACHINE OF THE PENDULUM TYPE.

H. F. Moore.*

This last spring, a new cement briquette testing machine became necessary in the Materials Laboratory of the University of Wisconsin to accommodate the increasing number of students. At the time when the class in Materials of Construction is taking laboratory work in cement, several universal testing machines in the laboratory are always standing idle, and it was decided in place of getting a new briquette machine to build a briquette breaking attachment for one of the universal machines.

This attachment applied to an Olsen 50,000 pound vertical screw testing machine is shown in the accompanying cut. The briquette is

*In Charge of Laboratory for Testing Materials, University of Wisconsin.



held in clips C C of the usual form, the clips being hung on pivots to insure simple tension in the briquette. The lower clip is attached to the pulling head P of the machine, and the upper clip is hung from the lever L by the knife edge K_1 . The force pulling on the briquette is transmitted (reduced) through the lever L L to the swinging Pendulum B, all points of contact being between hardened steel knife edges and plates ($K_1 K_2 \dots K_5$). The amount of force is indicated on scale S by finger F, which is pushed outward by the swing of the pendulum. The position of the pendulum under zero load is adjusted by the counterweight W_2 while the counterweight W_1 keeps all knife edges in contact with their bearing plates.

Force is applied by the regular mechanism of the universal machine, this attachment merely weighing the small amount of force required to break the briquette. When the briquette breaks, the pointer F remains at the outermost point of its swing, showing the breaking load, while the pendulum bob B strikes a wooden buffer R, preventing undue shock.

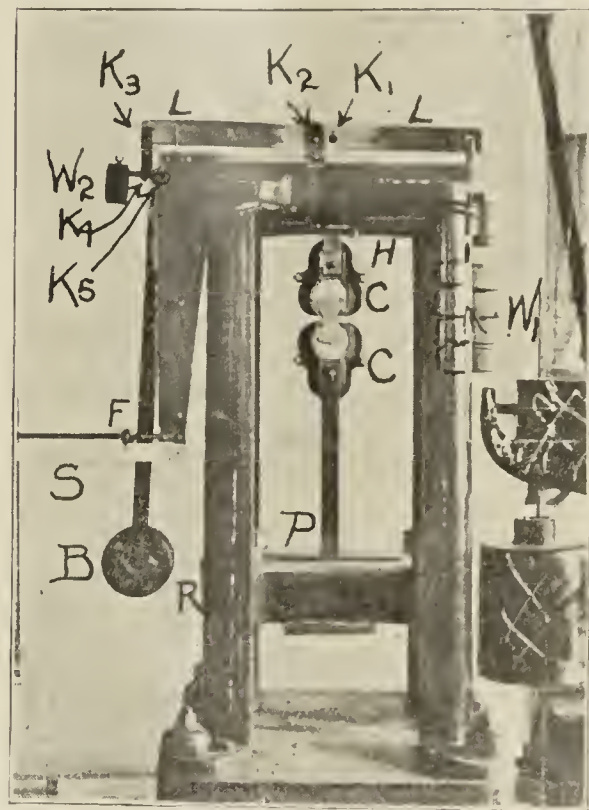
The scale on the machine built at the University of Wisconsin is hand graduated, and the divisions are not quite uniform tho nearly so. The upper clip, lever, pendulum and

scale are all fastened to a light frame-work which in turn is clamped to the weighing head H, of the testing machine. As built, the capacity of the attachment is 1,000 pounds, but by changing the position or weight of the pendulum bob B and changing the moment of the counterweight W_2 to correspond the capacity could be varied. As shown, the length of the scale is about ten inches, permitting readings to five pounds.

The operation of the apparatus has proven more rapid than that of a shot machine, while the personal

equation of the type of machine balanced by moving a sliding poise over a scale is eliminated, and the power drive of the universal testing machine furnishes a very steady application of force.

The cost of construction of the apparatus as shown—as an attachment for a universal testing machine—was about \$40, including the clips. In place of building the apparatus as an attachment, it could



of course be built as an independent machine with its own force applying mechanism either hand or power driven.

The machine shown was calibrated by using a brass briquette and balancing the beam of the testing machine at various loads using the small brass sliding weight furnished with the old style testing machines.

The Hecla Cement Company is lengthening four Kilns causing a 10 day shut down during which period the machinery was overhauled.

IMPORTS OF CEMENT INTO THE UNITED STATES.

WHERE FROM	JUNE				ELEVEN MONTHS ENDING JUNE			
	1906		1907		1906		1907	
	Quantity in lbs.	Value in Dollars	Quantity in lbs.	Value in Dollars.	Quantity in lbs.	Value in Dollars.	Quantity in lbs.	Value in Dollars.
United Kingdom	5,040,000	\$14,035	13,709,000	\$ 49,205	26,891,586	\$ 80,518	273,587,060	\$ 901,118
Belgium	3,600,019	9,501	24,293,866	76,567	122,845,140	383,449	340,008,797	1,054,749
France	666,600	2,283	1,518,800	5,320	9,011,976	32,730	16,298,318	60,936
Germany	22,256,202	63,071	7,365,912	22,976	213,773,247	713,817	413,909,830	1,303,281
All Other Europe					8,532	22	20,097,670	57,829
British North Am.	40,000	265	33,200	178	1,379,200	9,109	3,140,186	22,864
Other Countries	9,244,495	43,825	835,168	4,518	19,054,352	82,594	56,721,746	269,149
TOTAL	40,847,316	132,980	47,755,946	158,764	892,963,827	1,302,239	1,123,763,604	3,669,9
Domestic Exports of Cement, bbls.	52,968	85,203	93,988	168,471	809,678	1,165,161	709,455	1,180,415

There were 5,742,099 lbs. of imported Roman and Portland Cement, etc., in the United States bonded warehouses in June, 1906, valued at \$16,787, against 15,583,027 lbs. in June, 1907, valued at \$49,111.

For twelve months ending in June, 1906, there were 74,700 tons of asphaltum imported in the United States, valued at \$317,071, against 111,015 tons imported in twelve months ending June, 1907, valued at \$461,698.

THE HARDENING PROCESS OF HYDRAULIC CEMENTS.

By Dr. W. Michaelis, Sen.

Paper read at the Thirtieth annual meeting of the Association of German Portland Cement Manufacturers at Berlin, Germany, on February 21, 1907.

Translated by Dr. W. Michaelis, Jr.

Gentlemen. In my communications of today I will start out from fused calcium-alumina-silicates.

The following table shows the composition of some such fusions:

	A	B	C	D	E	F
Si O ₂	= 35.13	31.05	35.77	34.52	31.16	30.58
Al ₂ O ₃	= 11.97	10.58	12.97	14.07	12.72	14.31
Ca O	= 45.92	52.10	44.54	43.21	48.65	43.14
Mg O	= 1.38	1.30	1.72	1.67	1.51	3.16
FeO. MnO	= 1.00	0.90	1.00	1.53	1.44	1.33
Ca S	= 4.60	4.07	4.00	5.00	4.52	7.48
	100.00	100.00	100.00	100.00	100.00	100.00

The ratios of their molecular weights are:

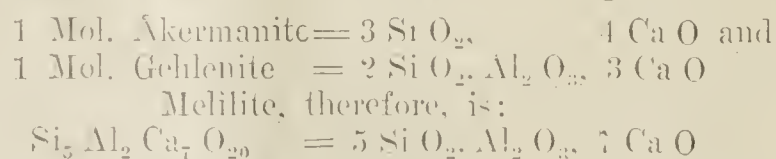
	A	B	C	D	E	F
Si O ₂	= 5	5	90	Melilite	75	Mel. D + 5,1
Al ₂ O ₃	= 1	1	5	Gehlenite	19	Gel. 10,6
Ca O (Mg O)	= 7	9				Ca O 1,1 8,7

(If, in the case of "F" all alumina is assumed to have contributed to forming gehlenite, that is to say, 2 Si O₂, Al₂ O₃, 3 Ca O, there remain 2, 3 mol. Si O₂ and 4,5 mol. of Ca O, hence almost exactly calcium ortho-silicate. This silicate, therefore, will disintegrate on cooling in the same manner as do "B" and "E.")

You recognize these as the compositions of such blast furnace slags as assume hydraulic properties upon combination with calcium hydrate, if they have previously been granulated, that is to say if they have been transformed into the glasslike state. They thus become slag-puzzuolana cements.

If a similar slag, for instance "B" which fuses at 1500° C. is cooled slowly, various minerals can crystallize from it. On cooling slowly down to 1300° C. augite is formed and hexagonal calcium meta-silicate, the unstable modification of wollastonite; on cooling rapidly to 1300° C. and then slowly to 1000° C. crystal mixtures are formed which the original investigator of the fused silicate solutions, Professor Vogt of Christiania, has termed the melilite group. He describes the melilite group as an isomorphous group occurring in high-limed aluminous silicate fusions forming mixtures of crystals of the same appearance and same specific gravity, splitting in a similar way and crystallizing in the tetragonal system. At the one end of this group we find the acidous akermanite and at the other the basic gehlenite.

"A" is such an ideal melilite consisting of:



But if a slag as "B" is cooled rapidly to a temperature below 1000° C. and then for a long time kept at a temperature between 900° C. and 700° C., it completely changes its structure and assumes a physical appearance entirely different from a slag which has been cooled quickly and completely; it becomes spongy and foamy and gives off sulphurous acid. This change is caused in the first place by the decomposition of the calcium sulphide which was dissolved in the silicate and in the second place by the dissociation of gehlenite; free calcium oxide separate, the gehlenite decomposes and forms anorthite and calcium oxide:

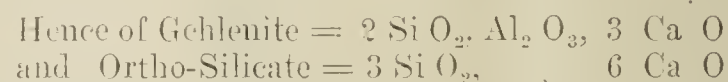
2 Si O₂, Al₂ O₃, 3 Ca O gives off 2 Ca O and forms 2 Si O₂, Al₂ O₃, Ca O. I shall come back to this later on.

For the formation of the above mentioned crystals it is of advantage or very likely even absolutely necessary that a certain percentage of magnesia be present. Vogt himself is of the opinion that about one-fifth of the calcium oxide must be replaced by magnesia, if akermanite is to be formed. Messrs. Day and Shepherd could not obtain akermanite from silica and calcium oxide. I have likewise tried in vain up to this time to obtain this mineral with certainty.

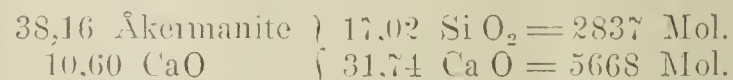
When I tried to fuse at 1600° C. a mixture of 9(Si O₂, 4 Ca O) + (3 Si O₂, 4 Mg O) in high-limed Portland cement mixture; the calcium silicate was fused completely, while the Portland cement clinker showed no signs of being affected; the fused mass, however, was completely disintegrated to the finest dust and the analysis showed that yet calcium oxide had been extracted from the Portland cement mass and that calcium ortho-silicate had been formed.

If the fused silicates under consideration have a higher percentage of calcium oxide, for instance 48 per cent to 52 per cent, they became very difficult to flux, because calcium ortho-silicate is formed instead of akermanite. The analyses of "B" and "E" show such fused silicates.

"B" consists of : 5 Mol. Si O₂, 1 Mol. Al₂ O₃ and 9 Mol. Ca O



"E" consists of 75 parts by weight of Melilite + 10.6 CaO + 19 Gehlenite, or if we consider the component parts of melilite, of:



and of: 55.84 Gehlenite, hence of: 48.76 parts by weight of Calcium ortho-silicate and 55.84 parts of gehlenite.

Akermanite and gehlenite fuse at about 1200° C.; calcium ortho-silicate, however, only at 2080° C.; hence the difficulty which arises in fusing too high-limed slags. Another peculiarity of such slags containing ortho-silicate in large amounts is their crumbling into dust. This is due to the transformation of the ortho-silicate into the γ modification at 675° C., which is accompanied by an increase of volume of 10 percent as Messrs. Day and Shepherd have demonstrated. In the same way Portland cement disintegrates, if it is too low in lime or if well-burnt Portland cement of a sufficient percentage of lime has been exposed to red heat for too long a time and hence the calcium oxide, which had been dissolved by the ortho-silicate, had an opportunity to disunite thus forming free ortho-silicate. The formation of crystals, however, which we observe in these fused silicates is of little interest to us. As crystalloids the silicates are of no value in the hydraulic hardening process. Only their possible dissociation and the separation of calcium oxide are points of interest as will be proven in the following.

For the hydraulic hardening process of slags only their glasslike, their colloidal state has to be considered, for in order to be in a position to form a hydraulic compound with lime solution the slag must be able to swell, that is to say it must be able to "adsorb" water and to form a gel. (The words "gel" and "hydrogel" have been coined by Professor Thomas Graham, Philosophical Transactions of the Royal Society of London, vol. 151. They designate the dry state of a gelatinous or colloidal substance

and that of the same substance more or less imbibed with water.)

You probably find it strange that I call glassy slag a colloid, but if you want to understand the nature of the hydraulic hardening process, you have to accept these views which I have been presenting for the last 15 years. Even our common glass is a colloid; also to this conception most of you are not accustomed and yet the original investigator of the chemistry of colloids, Thomas Graham, has taught this as early as 45 years ago.

All the minerals of which I have spoken so far, with the exception of augite, I have obtained by fusion of blast furnace slags. From these they crystallized under the proper circumstances. By cooling quickly I have converted them into the glasslike state. I then found that, with the exception of akermanite mixtures, every member of this series, that is to say calcium meta-silicate, gehlenite, melilite and anorthite, hardened with calcium hydrate.

The experiments with akermanite will be repeated, as I am not sure to have obtained sufficiently pure specimens of the glass $3 \text{ Si O}_2, 4 \text{ Ca O}$. In this effort to produce the various slag minerals, especially in their glasslike state, I have been ably assisted by Dr. Passow. Everybody who has carried on similar experiments knows how difficult it is to obtain pure products. We have not always been successful in our endeavors, yet the desired insight into the hardening process of these fused products could at least be obtained. I am, therefore, under deep obligation to Dr. Passow and his assistants for their kind co-operation.

All of these glassy products, excepting the akermanite mixture, show upon combination with lime-water a noticeable swelling. The amount of lime, however, which goes into combination during the formation of "hydrogels" is small, with the exception of anorthite.

100 p. b. w.* of meta-silicate glass combined with	3.7 p. b. w.* CaO .
100 " " " gehlenite glass	5.7 " " " "
100 " " " melilite glass	6.1 " " " "
100 " " " anorthite glass	13.4 " " " "
100 " " " akermanite glass	0.0 " " " "
100 " " " slag "F"	4.5 " " " "

* p. b. w. = parts by weight.

That slag "F," which is able to form 39 per cent. of ortho-silicate in addition to 53.5 per cent. of gehlenite, has combined only with 4.5 parts of calcium oxide, although it contains more gehlenite than the typical melilite "A," is to be explained by the behavior of the ortho-silicate. This gives off 10 per cent. of its calcium oxide to the water, as I have found on material which I owed to the courtesy of Dr. Schott. Messrs. Day and Shepherd found that the percentage of calcium oxide given off amounted to about 10 per cent. of the ortho-silicate. Hence this means a still larger separation of calcium oxide. The calcium hydro-silicate which I obtained was $5 \text{ Si O}_2, 9 \text{ Ca O} + \text{aq}$, that of Messrs. Day and Shepherd $5 \text{ Si O}_2, 8.5 \text{ Ca O} + \text{aq}$.

If the glassy slags "A" and "F" are gauged with water, they do not harden; but if we add to the water sodium hydroxide (from 4 to 7 per cent. of the slag used), they harden perfectly and yet no sodium enters into combination with the hardened compound. How is this hardening to be explained? It is made possible by a reaction between the sodium hydroxide and the calcium sulphide, which form calcium hydrate and sodium sulphide; 72 parts by weight of calcium sulphide form 74 parts of calcium hydrate and 78 sodium sulphide. The slags "A" and "F," therefore, yield from 4 to 7.7 per cent. of calcium hydrate and

this amount is entirely sufficient to bring about the hardening.

Hence, the glassy, water or air granulated, that is to say, quickly and completely cooled, slags with a sufficient percentage of calcium oxide are puzzuolanas, for they are silica compounds which form hydraulic cements upon combination with calcium hydrate. This covers the definition of puzzuolanas, which are natural or artificial silica compounds that are, so to speak, not yet saturated with lime, and consequently can swell with lime solution.

Now I wish to show you the result of the treatment of melilite and gehlenite glasses with lime water; that is to say, I will apply my new method of experimenting, which I have discussed with you a year ago (see "Constitution of Hydraulic Cements" Cement and Engineering News, June, 1906), to the glass-like state of the calcium-alumina-silicate mixtures which correspond to the combination of melilite and gehlenite:

100 centigrams of melilite glass were agitated with 1000 ccm of lime water containing1,2432 gr Ca O
After 3 months' treatment 1000 ccm of lime water contained1,1832 gr Ca O

Hence amount of lime gone into combination0,0610 gr Ca O

ANALYSIS:

$\text{Si O}_2 = 38,278 = 637.967 \text{ Mol. times } \frac{5}{4} = 797.459 \text{ CaO}$
or times $\frac{3}{2} = 956.950 \text{ CaO}$

$\text{Al}_2 \text{ O}_3 = 12.963 = 126.840 \text{ Mol.}$
 $\text{Ca O} = 49,013$
+ 6,100

$\text{Ca O} = 55,133 = 984.160 \text{ Mol.}$
— 797.459

186.701 Mol. for $\text{Al}_2 \text{ O}_3, \frac{186.701}{126.840} = \frac{3}{2}$

Hence have been formed either

Smeatonite and Tricalcium-Dialuminate
 $4 \text{ Si O}_2, 5 \text{ Ca O} + \text{aq}$ and $2 \text{ Al}_2 \text{ O}_3, 3 \text{ Ca O} + \text{aq}$
or Vikatite and Alumina hydroxide
 $2 \text{ Si O}_2, 3 \text{ Ca O} + \text{aq}$ and $\text{Al}_2 \text{ O}_3, 3 \text{ H}_2 \text{ O}$

100 centigrams of gehlenite glass were agitated with 1000 ccm of lime water containing1,09062 gr Ca O
After 3 months' treatment 1000 ccm of lime water contained1,03370 gr Ca O

Amount of lime gone into combination..0,05692 gr Ca O

ANALYSIS.

$$\text{Si O}_2 = 31,776 = 52,960 \text{ Mol. times } \frac{3}{2} = 79,440 \text{ Ca O,}$$

$$\text{or times } \frac{1}{1} = 52,960$$

$$\text{Al}_2 \text{O}_3 = 25,789 = 25,234 \text{ Mol.}$$

$$\text{Ca O} = 42,077$$

$$+ 5,692$$

$$\text{Ca O} = 47,769 = 85,302 \text{ Mol.}$$

$$- 79,440$$

$$5,862 \text{ Mol. for Al}_2 \text{O}_3,$$

$$85,302$$

$$52,960$$

$$32,342 \text{ Mol. for Al}_2 \text{O}_3 = \frac{3}{2}$$

Consequently have been formed either vikatite, alumina hydroxide and a small percentage of calcium aluminate or winklerite Si O_2 , $\text{Ca O} + \text{aq}$ and tri-calcium di-aluminate.

We have always to remember that colloids do not yield well-defined compounds in the manner to which we are accustomed from crystalloids.

In addition to the method of cooling slags so far referred to, the cooling process of similar blast furnace slags can be directed in such a way that they require no further admixture of calcium hydrate, but harden independently when gauged with water. This is a patented process worked out by Dr. Passow. It is based upon keeping in the course of the cooling process part of the slag sufficiently long at a temperature of from 700° to 900° C. so that it can dissociate, as previously described; that is to say, that gehlenite can be decomposed into anorthite and calcium oxide. By this process part of the calcium sulphide is transformed into calcium sulphate and calcium oxide, whereby sulphurous acid escapes. Thereby the slag becomes porous or spongy. It contains free lime, as a study of microscopic sections shows. The presence of free lime is likewise revealed by the energetic reaction with carbonic acid, upon which Dr. Passow has based an analytical method of determining the value of these slags.

If with the above mentioned slags A, C, D and E with from 46 to 56 per cent of gehlenite complete dissociation into anorthite and calcium oxide would take place from 13 to 16 per cent of calcium oxide would become free. From this follows, that even a partial decomposition of gehlenite suffices in order to supply the calcium oxide needed for the hydraulic hardening process. Dr. Passow mixes, for instance, 60 parts by weight of glassy slag with 40 parts of porous, spongy slag. The 60 parts of glassy slag require only from 2 to 3 parts of calcium oxide for their hardening, which the 40 parts of dissociated slag can supply. I have made a thorough study of such slag mixtures, and by many years of experience I am able to say that from freshly made Passow cement, manufactured exclusively from glassy and foamy slags, excellent hydraulic cements of high strength can be obtained, but such slag mixtures will not stand ageing or storage. The small amount of free lime in them is in so perfect a state of subdivision that it is soon converted into carbonate of lime by the influence of the moisture and carbonic acid of the atmosphere. After this is done self-hardening of this cement is out of the question of course. Dr. Passow, therefore, had to search for a more stable source of lime. He found it in Portland cement. Now he mixes from 15 to 25 parts of Portland cement with

from 75 to 85 parts of slag capable of hardening; that is to say, mainly glassy slag. This amount of Portland cement starts the hardening process; it thus acts as a catalysator. It gives off, as we know, from 3 to 5 parts of lime in the course of its hardening process, which become available for the slag and contribute to the hardening of the latter.

Such are the proceedings in the course of the hydraulic hardening process of the sufficiently high-limed calcium-alumina-silicates, the blast furnace slags, according to my experiments carried on for many years.

Now I am going to describe the phenomena due to swelling:

In this glass cylinder you see a gelatinous mass occupying about 180 cubic centimeters. It has been obtained by the swelling of 2 grams of melilite. This had previously been fused to a vitreous clinker and afterwards been pulverized very finely. Then the two grams of substance had been agitated with a concentrated lime-water solution. In consequence of this treatment they have combined with from 6 to 7 per cent of calcium oxide and a large amount of water. The specific gravity of melilite is 2.9. The two grams of the powdered substance, therefore, originally occupied a space of about 0.7 cubic centimeter. Hence by swelling the substance has increased its volume more than 200 times. In the other vessel you observe the effect of lime-water on 3 grams of powdered melilite. In this case I have succeeded in making swell almost all of the minute particles independent one from another, so that you may see what swelling will do under the most favorable circumstances. If you stir the contents of this flask, you plainly see every single little grain of the powdered silicate swelled to a gelatinous flake; such perfect swelling is made possible only in liquids where expansion is unhindered. The substance has to be agitated continuously in the beginning, and thus to be kept in suspension, lest the grains in contact one with another inter-lock, stick together and harden; if this has been neglected from the start, it is impossible to separate the particles of the consolidated mass even by the most violent shaking.

How is this swelling to be explained?

I shall try to make this clear to you by an illustration. Imagine a bath sponge moistened and then compressed as much as possible and in this shape perfectly dried; it now occupies a very small space. If put in water and swelled completely, it will increase its volume 50 or 100 times.

In the same condition you must imagine to be the grains of granulated slag, of fused or vitrified cement, and in general of all hydraulic compounds. The water penetrates into the honeycombed mass by osmotic diffusion and fills the cells. The walls of the cells distend as the pressure increases. In this manner the "hydrogel," the water-saturated gelatinous mass, is formed. In the same way as the sponge can be compressed by expulsion of all of the absorbed water, the hydrogel of Portland or slag cement and of any hydraulic compound can be compressed to a solid body by expulsion of the water.

In metaphysics this state of matter is called a sub-microscopic foam; chemists designate it as a gelatinous substance, as a colloid. We know more or less liquid colloids and even solid colloids. Only liquid foam-lamellae have cell walls which make osmotic diffusion possible, and which can swell and permit of unhindered exchange of substances; that is to say, of complete reactions. Solidified colloids, the walls

of which have been transformed into solids, are an obstacle to the free exchange of liquids, make reactions difficult, and finally with increasing hardening become perfectly impervious to liquids. Silica in the form of flint is the best example of a completely impenetrable hardened colloid.

Upon the existence of the hardening and solidifying colloids, created during the hardening process of all calcareous hydraulic cements depends their durability in water; the formation of a solidified colloid as the chief element of the hydraulic cements is the characteristic and the only essential feature of the hydraulic hardening process. Whenever free silica partly uncombined, as is the case in *puzzuolanas* and slags, comes in contact with lime (calcium oxide) and water, or when water acts upon silica oversaturated with lime, as in Portland cement, colloids are formed, and it is of no consequence whether there are 1, 2, 3, 4, 5 or 6 molecules of calcium oxide present for each 4 molecules of silica; in all cases colloidal calcium hydro-silicate is formed. The amount of lime surpassing 6 molecules of calcium oxide is in the beginning enveloped in the colloids as colloidal calcium poly-hydrate, but mostly crystallizes later as calcium mono-hydrate. The more lime combines with the silica, the more firmly the colloids solidify as a rule. Any modification of silica forms hydro-silicate when in contact with calcium hydrate, even quartz silica which latter, as you know, has to be heated to over 90° centigrade in order to facilitate the reaction. Iron oxide and to some extent also alumina act in a similar way, but are not necessarily required for the formation of a hydraulic cement; calcium oxide, silica and water suffice for this purpose.

Now let us diverge from the path which we are following and carry out a few experiments.

I am going to make use of a flask with distilled water, of a silica-salt solution and of a calcium salt-solution. I pour two drops of sodium silicate into 800 ccm of water; by this I create a very diluted silicate solution. Now I add two drops of calcium chloride solution and stir. You immediately observe clouding caused by formation of calcium hydro-silicate, most likely $\text{SiO}_2 \cdot \text{CaO} + \text{aq}$, mono-calcium hydro-silicate. You probably have noticed the suddenness and sensitiveness of the reaction,

If I add several cubic centimeters of sodium silicate and calcium chloride and stir again, you see the hydrogel coagulate and form a flocculent mass which gradually settles, because at the same time an electrolyte, namely sodium chloride, is formed. All colloidal solutions, "soles," coagulate in the presence of electrolytes. Now I will try to mix in a porcelain mortar concentrated sodium silicate and calcium chloride solutions. On account of the rapid reaction mixing is made difficult; stirring soon becomes impossible; nevertheless I continue to mix by compressing the contents of the mortar until the pestle is arrested by the solidified hydrogel, and yet in this case many times more water than cementing substance has been used. We, therefore, have obtained a very voluminous swelled colloid.

But in actual practice we use for gauging hydraulic cements only about the same amount of water as cement; consequently we obtain a much denser colloid.

This is an unavoidable necessity, since otherwise a mortar would be obtained which would show shrinkage cracks.

For every one who does not wish to go very deeply into this study of the hydraulic hardening process it is only necessary to remember this reaction; the formation of the calcium hydro-silicate gel is the car-

dinal point of the hardening process of all calcareous hydraulic cements.

Now the question presents itself: How can a colloid harden in water? In the air by drying out, this is feasible; but in water, how is that to be explained?

Very voluminous swelled colloids, hydrogels containing large amounts of water, can contract even in water, but will hardly petrify in water. Besides, it is a wrong conception to imagine a swelled colloid always to be a soft substance. This idea has certainly originated from our calling in every day language soft semi-liquid substances gelatinous substances,

How solid and hard or how soft the gel is entirely depends upon the degree of swelling.

If pulverized Portland cement is gauged with an equal volume of water and left to rest, we obtain by water-adsorption a mass swelled only so far as the volume of the paste permits, for the grains of the pulverized cement stick one to another and this interferes with their individual expansion; as a result of this the mass consolidates. Or if we carefully pour the cement into water, the water penetrates into the interstices and is adsorbed by the cement; the grains begin to swell and immediately stick one to another. By osmotic diffusion water can enter the cement only until equilibrium of pressure is obtained. As soon as all interstices are filled by swelling further admission of water is made impossible, the gel has become impervious to water. Only if the grains of the powdered cement are free and unhindered, for instance, if they are kept in suspension by continuous agitation of the water, and if they are thus not influenced by one another, they can swell perfectly and can form a very voluminous, soft hydrogel.

About forty-six years ago experiments of this nature induced Frederick Ransome to manufacture artificial sandstone from sodium silicate and calcium chloride solutions and from sand or crushed minerals. Thirty-three years ago I have described his process in a paper read before this society. I am going to repeat a few paragraphs of this paper in order to recall Ransome's process to your memory:

"On the 9th of April, 1861, the first patent was granted to him, which was mainly based upon moulding in forms a mixture of powdered chalk, with or without admixture of sand, and sodium silicate and following coating and hardening by means of a calcium salt solution.

After some practical experience a more effective impregnation by means of attenuated air instead of absorption or coating was found necessary. Upon this an additional patent was based,

In the following I will briefly describe the process of manufacture: The raw materials are sand, sodium hydroxide, calcium chloride and soluble silica, infusorial earth or flint. Sharp quartz sand, which must be as pure as possible, is cleaned by careful washing from all loose and loamy particles, then dried and afterwards graded by sifting. The sodium silicate is manufactured from flint and concentrated sodium hydroxide in boilers at a pressure of from 4 to 6 atmospheres. The raw materials are added in such quantities that a very concentrated solution ensues. The silicate solution is passed into settling tanks, where it is clarified. From these tanks it is drawn, ready to be mixed with the necessary ingredients and to be moulded. It has the consistency of jelly, and represents pure sodium silicate. The mixing of the silicate and sand, or a substance that takes the latter's place, for instance, pumice stone, glass and so forth, according to the effect desired, is done very

carefully and thoroughly by means of edge-runners. In this process the sand is further reduced in size and intimately mixed with the sodium silicate. Thus a plastic dough is formed consisting of sodium silicate and quartz, which is tamped or pressed into moulds of plaster, wood or cast-iron.

The taking out of the forms requires some skill, since the mass possesses only limited cohesion; yet the cohesion is sufficient to make it possible to transport good-sized pieces, if handled by experienced men. After having dried for some time the blocks are placed into a calcium chloride solution. In this bath they are supported in such a way that they are completely submerged and that as much of their surface as possible is exposed to the surrounding liquid. In order to facilitate the penetration of the calcium chloride solution a powerful air-pump is used, which by means of suction discs with numerous openings draws the air out of the block. Large pieces are preferably made hollow in order to enable the solution to penetrate to the center. The reaction between calcium chloride and sodium silicate sets in immediately. After having passed through this process, the blocks are placed into a hot calcium chloride solution in order to make the chemical combination more perfect, if this is possible, for they possess already a considerable strength upon leaving the first bath.

All that remains to do is to wash out the alkali-chloride resulting from the action of calcium chloride upon sodium silicate. This is a rather tedious process, especially in the case of large blocks. Where pure, running water is to be had in abundance it suffices to leave the blocks long enough in the water. Otherwise they are placed in "rain-chambers," in which they are continuously sprayed for days and weeks according to the size of the piece. Water containing iron must be carefully avoided in this process, because this would discolor the artificial stone by forming iron hydroxide, which can be formed as long as alkali-hydroxide or carbonate is left in the block.

Experience has shown that also with this cement the strength increases with age, for the calcium hydro-silicate which causes the adherence of the sand grains represents the cement. The experiments which I have made date back only to September of last year (1873).

The tensile strength of test pieces made from coarse sand was:

After 14 days 510 lbs. per sq. in.
After 60 days 640 lbs. per sq. in.
After 120 days 800 lbs. per sq. in.

These figures represent in each case the average of ten briquettes which were kept in air.

However, this process had one very weak point. The colloid which formed was so solid and dense that it made the completion of the process extremely difficult. With large blocks the calcium chloride solution could not penetrate to the center. Notwithstanding the application of rarefied air the sodium silicate in the center of the piece could not be reached by the calcium chloride solution. On the other hand, even if perfect reaction was made possible and the piece had been hardened to the center, the sodium chloride could not be washed out even after continued washing for weeks and months."

This process, therefore, proved to be uneconomical.

In the summer of 1873, when I started the first Swedish Portland cement plant at Lomma, I became acquainted with this Ransome process for the manufacture of artificial stone at the works of Julius Erichsen at Saltholm, Copenhagen. There I learned to ap-

preciate the advantages and disadvantages of this process. My subsequent efforts of devising a method which would be free of the objections adhering to Ransome's process led me to the invention of the high-pressure hardening process. But by the time I had this process worked out, and a patent was granted to me in 1880, Julius Erichsen and Frederick Ransome were at the end of their experiments. My friend Erichsen was utterly discouraged. Thus it happened that my process remained unused. You know that it took a long time before it was appreciated. I am unfortunately not an exploiter.

The high-pressure hardening process became capable of existing only after it had been proven that sand-lime brick made under my process could compete with common clay brick, which I did not anticipate from a carefully conducted process of manufacture. The sand-lime brick industry sprang into existence, and, strange to say, dozens of patents were applied for and granted, although my patent, which consisted only of a few lines, completely covered all these various claims. My patent covered "the hardening process and the combination of all modifications and all compounds of silica with calcium hydroxide at temperatures above 100° C. in the presence of saturated steam, that is to say, high pressure." In spite of this letters-patent were granted based upon the use of admixtures to the quartz sand or upon the use of silicate sands or clay or infusorial earth. It is beyond my conception why these claims were allowed in the face of my former patent.

The sand-lime brick manufacturers undoubtedly deserve credit for having brought the high pressure hardening process into general use. But nevertheless I was deeply disappointed with the outcome of my endeavors.

From this artificial sandstone which I show you here, and which was made under Ransome's process, you may see for what I was striving. If you compare with it the sand-lime brick so far produced, and if you consider that the manufacturers are hardly willing to guarantee a compression strength of 2,000 pounds per square inch, you will be able to appreciate my feeling in this matter. In fact it is easy to manufacture artificial sandstone of a compressive strength of from 9,000 pounds to 12,000 pounds per square inch, of course not for \$4 a thousand.

When will the time come when we shall learn to produce elaborately worked out and highly finished ornamental blocks, and when we shall attain what I conceived from the beginning? Of course moulding machinery different from our common brick presses has to be devised for this purpose.

This identical stone I showed you in my lecture thirty-three years ago. (The artificial stone referred to is a highly finished 6-foot lintel in Grecian design.)

Recently I have broken off a piece and have carefully analyzed it. Outside and inside could have been expected to have a different composition. The center may still contain sodium chloride, although the stone never showed efflorescence of salt. Therefore, an average of the whole piece and separate samples of the outside and of the inside were tested for loss at red heat, carbonic acid and chlorine.

Average of the			
	whole piece.	Outside.	Inside.
Carbonic Acid	trace	trace	trace
Water	1,082%	1,315%	0,758%
Carbonic Acid	3,617%	3,665%	3,573%

The complete analysis of the stone showed the following composition:

Artificial Sandstone Manufactured in 1873 Under Ransome's Process by Julius Erichsen, Saltholm, Copenhagen.

	1907:	1873:	1907:
Soluble Silica	= 1,794%		
Iron Oxide plus Alumina..	= 0,295%	Si O ₂ = 4,794	4,794 + 0,720 H ₂ O
Calcium Oxide	= 4,601%	R ₂ O ₃ = 0,295	0,295 + 0,121 H ₂ O
Calcium Sulphate	= 0,105%	Ca O = 4,601	4,601 + 3,615 C O ₂
Magnesia	= 0,047%	H ₂ O = 3,000	
Sodium Chloride	= 0,153%	12,690	14,146
Carbonic Acid	= 3,595%		
Water	= 1,141%		
Quartz Sand	= 85,556%	Si O ₂ , Ca O + aq	2 Si O ₂ + 1 H ₂ O and CaCO ₃
	100,287%		

In 1907 the dry inside absorbed 13.2 per cent of water, determined by boiling and cooling in water. When made thirty-three years ago it was impervious to water; at that time all voids were filled by the hydrogel Si O₂ Ca O + aq. Hence the stone became porous by drying out and by gradual decomposition of the calcium hydro-silicate.

The result of the chemical investigation is that the inside and outside of the stone prove to have the same composition. Consequently the carbonic acid of the atmosphere has entered the inside. Furthermore, the analysis shows that the stone had been washed out completely, for it contains only 0.153 per cent of sodium chloride. Moreover, we learn from it that the mono-calcium hydro-silicate has been completely decomposed by the carbonic acid of the atmosphere, and has formed silica half-hydrate and carbonate of lime.

(Every one who has doubted whether or not hydraulic cements can form stable compounds may see in this the best proof for the fact that all of them are completely decomposed by carbonic acid, whenever and wherever this latter can act upon a cement. Another lesson we learn from this is that sand-lime brick must not be laid with lime-mortar, but with cement or cement-lime mortar, which sets and hardens without the aid of carbonic acid, for the carbonic acid cannot penetrate to the layers of binding mortar, because it is absorbed by the brick itself.) A higher grade of stone and a more durable one, so free of all efflorescence, can hardly be imagined. Moreover, what should cause efflorescence with a stone containing 85.5 per cent quartz sand, 5.5 per cent silica hydrate, 8.2 per cent calcium carbonate, 0.3 per cent iron and alumina hydroxide? And last but not least consider its extraordinary strength! We have to regard this product as an ideal artificial sand stone.

If you make the most rational use of the highest grade of Portland cement, that is to say, if you grind it with twice as much quartz sand to a very fine powder, and then mix it with seven parts of coarse quartz sand you can never attain a stone of so high a strength and this is easily explained. So intimate a mixture of sand and cement as in Ransome's process can never be attained, not even with the most finely pulverized substances obtainable in practice,

The preceding information is one of the proofs for the correctness of my statement that only silica, lime and water are necessary for the production of a perfect hydraulic cement, and that this calcium hydro-silicate is a hardened colloid.

Thus thirty-three years ago I had already demon-

strated that this pure calcium hydro-silicate which I had designated at that time as the root of all hydraulic compounds had a tensile strength of 510 pounds per square inch after 14 days, of 640 after 60 days, and of 800 after 120 days, when mixed with 9 parts of sand. Therefore, you can imagine my surprise upon reading the following statement in Dr. Rohland's article in number 18 of the Tonindustrie-Zeitung, February 9, 1907:

"So far no one has succeeded in obtaining a silicate, aluminate or a mixture of them which shows anything like the hardening properties and resistance to tension and compression as does Portland cement."

Very likely Dr. Rohland was not born when Ransome fully achieved this and even far excelled the properties of Portland cement, and Rohland still went to school when, thirty-three years ago, I demonstrated before this society how superior a product can be obtained from pure silicate. Dr. Rohland is evidently not familiar with the literature on the subject.

I now shall describe to you a very ingenious invention based upon my interpretation of the nature and the properties of hydraulic cements. The invention consists in treating Portland cement like rags in the beater and on the calender. You would naturally be surprised to see a man try to treat Portland cement like paper pulp, and you would question his conception of the properties of cement, and yet he merely makes use of what I have taught about hydraulic cements at the Stockholm Congress in 1897, namely, that by swelling in water they increase their volume twenty times and even more, and are transformed into a flocculent gelatinous substance. In order to briefly illustrate this swelling and to recall it to your memory, I show you the result of continuous agitation of 15 grams of Portland cement and 15 grams of slag cement with 40 times as much water. In the beginning of this experiment the whole flask was filled with flakes of a colloid. Since then five years have passed during this time the colloid has contracted and hardened under water, and yet you observe that the volume of the colloid is still from 20 to 25 times that of the original cement.

In the same manner the inventor continuously stirs and agitates two pounds of cement with 50 quarts of water, and obtains a dough which he transfers to a fine sieve and which he treats in the same manner as hand-made paper is manufactured. Then he presses out all surplus water by means of a press, and lets the plate dry very gradually. The slab grows harder and denser in time, and finally has the properties and

appearance of slate. I suppose you would like to see such a slab. Here it is. I have to add that the inventor has worked from 10 to 20 percent of asbestos fiber into his product in order to obtain complete intertwining and in order to decrease the brittleness of cement as much as possible. This artificial slate or cement board containing from 80 to 90 per cent of neat cement is called "eternite" (everlasting); it is manufactured by beater and calender in the same way as card-board. The name is very pretentious, but the inventor is right in giving it this name, for people are nowadays so accustomed to being promised ten times beyond what can be performed for fear an article, no matter how perfect, will not become conspicuous; strange but true nowadays more than ever, the people like to be humbugged. Fortunately the properties of eternite are not exaggerated; this is a splendid invention indeed, an excellent application of the deductions from my research work. However, we do not build for eternity; no sensible person demands this, and the least of all the manufacturer.

The last described invention was the second practical example of my "gel-theory."

The knowledge of the foregoing will enable you to understand and to appreciate my deductions.

I beg you once more to look at these swelled hydraulic cements which I used as illustrations ten years ago at the Stockholm Congress. In the first place the swelled silica, then the quartz powder which has been made to swell by lime water on a water bath at about 100° C., and which represents the cementing material in sand-lime brick, furthermore swelled trass, santorin earth, Roman cement, Portland cement, hydraulic lime from Teil, and here the formerly discussed melilite.

Let me repeat what I said about these swelled substances in the beginning of my paper. In metaphysics this state of matter is called a submicroscopic foam; chemists designate it as a gelatinous substance, as a colloid. We know more or less liquid colloids and even solid colloids. Only liquid foam-lamellae have cell walls which make osmotic diffusion possible, and which can swell and permit of unhindered exchange of substances, that is to say, of complete reactions. Solidified colloids, the walls of which have been transformed into solids, are an obstacle to the free exchange of liquids, make reactions difficult, and finally with increasing hardening become perfectly impervious to liquids. Silica in the form of flint is the best example of a completely impenetrable hardened colloid.

Upon the existence of the hardening and solidifying colloids, created during the hardening process of all calcareous hydraulic cements depends their durability in water; the formation of a solidified colloid as the chief element of the hydraulic cements is the characteristic and the only essential feature of the hydraulic hardening process. Whenever free silica or silica partly uncombined as is the case in puzzolanas and slags, comes in contact with lime (calcium oxide) and water, or when water acts upon silica oversaturated with lime, as in Portland cement, colloids are formed, and it is of no consequence whether there are 1, 2, 3, 4, 5 or 6 molecules of calcium oxide present for each 4 molecules of silica; in all cases colloidal calcium hydro-silicate is formed. The amount of lime surpassing 6 molecules of calcium oxide is in the beginning enveloped in the colloids, as colloidal calcium poly-hydrate, but mostly crystallizes later as calcium-mono-hydrate. The more lime combines with the silica, the more firmly the colloids solidify as a rule. Any modification of silica forms

calcium hydro-silicate when in contact with calcium hydrate, even quartz silica, which latter, as you know, has to be heated to over 90° centigrade in order to facilitate the reaction. Iron oxide and to some extent also alumina act in a similar way, but are not necessarily required for the formation of a hydraulic cement; calcium oxide, silica and water suffice for this purpose.

Every neat cement briquette when perfectly hardened shows how thoroughly impervious the colloidal ground mass is which is composed of the hardened calcium hydro-silicate calcium hydro-aluminate and calcium hydro-ferrite. The briquette, which may have been kept in water for years shows on breaking an absolutely dry light-colored core surrounded by a dark moist zone. This difference between damp outside and dry inside is to be explained by the action of the carbonic acid on the cement. The carbonic acid penetrates from the outside into the hardened colloid, decomposes the calcium hydro-compounds and forms calcium carbonate in them, whereby it expels a certain amount of water. Rhombic calcspar crystals interrupt the cohesion of the formerly dense colloid, and thus form submicroscopic fissures between the separating walls of colloid and crystals, which permit the water to penetrate into the mortar.

As another very instructive example of the impermeability of hardened hydro-silicates I should like to mention the following: If you tamp into a capsule of filter paper of a diameter of 2 centimeters a mixture of 2 parts of finely pulverized trass and 5 parts of standard sand, seal it and hang it into permanently saturated lime-water, you will never obtain more than a hardened filter paper shell; a thin hard crust (about 1 millimeter thick) is formed comparable with an egg shell. Immediately after immersion of the capsule into the solution a small amount of lime-water penetrates into the capsule, but beyond this not a trace of lime reaches the powdered trass. No matter how long you may wait, you will always find inside of the capsule a mass without any cohesion whatever, and water absolutely free from lime filling the interstices of the mixture.

From experience you know that the hydraulic hardening process is always more or less accompanied by a process of crystallization. The formation of crystals, however, is of minor importance, it is inconsequential, and considering it as a whole it is more of a detriment.

As a matter of fact, the formation of crystals greatly contributes to the strength, especially in the later stages of the hardening process; but, which is of more consequence, it impairs and finally destroys the durability of the cement in water which it owes to the hardened colloid. Hence the colloids are the cause of the durability of the hydraulic cements, whereas the crystalloids work their destruction. The more elaborate the process of crystallization in cements, the sooner they are doomed to deterioration.

As previously stated, the separating walls between the hardened colloid and the crystals permit access to the liquids which means ultimate destruction. Even in the presence of pure water chemical reaction sets in immediately; lime, gypsum and aluminate go into solution and act one upon another. But if the percolating liquid is charged with salts, for instance if sulphate solutions or sea water or acidous water enter into play, very energetic reactions go on. The formerly submicroscopic interstices widen to microscopic fissures and these grow in course of time to macroscopic cracks and crevices; at first hair cracks are formed, and by and by large rents. The formation of crys-

tals, which is accompanied by increase of volume, ultimately with irresistible power causes the mortar to burst more or less completely. Or, on the contrary, the lime is gradually dissolved and carried off and only softened hydrates of silica, iron oxide and alumina remain instead of the original rock-like hardened colloid.

Therefore, the possibility of access of solutions includes unavoidable deterioration. There are some variations or exceptions to this rule; thus colloids may be formed besides crystalloids in the course of the reactions caused by entering solutions. This may delay ultimate destruction or make it even temporarily impossible. As an example of this phenomenon I mention the formation of magnesium hydroxide caused by the action of sea water. Furthermore I must mention that carbonic acid acts in two ways: it becomes injurious by its separating the cohesion of the hardened colloid, and becomes beneficial by making the lime insoluble or difficult to dissolve. From the foregoing you see that very complicated processes may take place. But all the phenomena we may observe are easily reduced to and found to be based upon the following two processes:

1. Formation of a colloidal fundamental substance composed of calcium hydro-silicates calcium hydro-aluminates and calcium hydro-ferrites which forms the characteristic and the essential part of all hydraulic cements, and is the cause of their hydraulicity, and

2. Formation of crystalloids, as, for instance, calcium aluminates, calcium sulphate, calcium and magnesium carbonate and calcium sulpho-aluminates, which as a rule increase, even sometimes considerably increase the strength of the ground mass in which they are imbedded, but which at the same time cause formation of cracks within the hardened colloids, thus admitting solutions and leading to destruction; or, in other words, existence of processes of crystallization, which are the cause of instability and short life of the hydraulic cements.

When about ten years ago I first discussed this subject at the Stockholm Congress my points were not comprehended; nay, even the most prominent of my collaborators in this branch of science, the well-known savant, H. Le Chatelier, who is unable to conceive the hydraulic hardening process as anything but a pure process of crystallization, declared my views to be entirely wrong; but never mind, time will tell!

I hope to be more successful with my present communications and with the paper which I read a year ago before this association, and trust cement experts will in the future try to comprehend and entertain and fathom my views, which they have not done heretofore.

The conclusions to be drawn from the foregoing with reference to practical application must be the following: Hydraulic cements will be the more reliable and the more durable the more limited the process of crystallization during their hardening; hence hydraulic cements low in alumina and lime are the most preferable. The surplus of lime crystallizes, and favors formation of calcium sulpho-aluminate in the presence of aluminates and sulphates; or the surplus of lime is dissolved and carried off, and in consequence the cement becomes porous. The alumina, on the other hand, forms unstable crystals of calcium aluminate, and in presence of sulphate solutions the dreaded calcium sulpho-aluminates.

To the group of hydraulic cements low in lime belong the Roman or natural cements, slag cements and puzzuolana cements. They have, however, this dis-

advantage that they are very incompact and consequently form colloids which are less dense, which therefore greatly increase their volumes by swelling, and which for the same reason shrink considerably on drying. A further drawback is their high percentage of unstable aluminates. To the cements low in alumina belong the siliceous hydraulic limes, for instance, the famous hydraulic lime from Teil, the grappier cement and the iron-ore cement; these however, are all high in lime.

Iron-ore cement is, as a matter of fact, an ideal hydraulic cement, because its calcium ferrites never crystallize, and possess, if vitrified wonderful resistance under all circumstances. Moreover iron-ore cement belongs to the strongest cements and yields the densest mortars, for it has the highest specific gravity of all Portland cements; its density is 3.3 to 3.4. A large cement company manufactures this new cement with only about 1 percent of alumina; but its use has been rather limited so far, evidently on account of insufficient advertising.

As valuable as the properties of the colloids may be, if the cement is used in water, where its durability can only be impaired by formation of crystalloids, I am not allowed to leave unmentioned that the colloids do not behave equally well in cements exposed to air. In this case the cohesion of the colloids is gradually impaired by drying out, which causes shrinkage cracks, for, as well as colloids swell in contact with water, they dry out, contract and shrink in air. Such shrinking is accompanied by loss of water,

How slowly this latter process goes on you may see from the following observation: About 3 grams of smectonite (calcium tetra-ortho-silicate, a compound which I showed you last year, at first in the form of a colloidal substance of the same physical appearance as the melilite which I showed you to-day, and afterwards as a very hard substance which had been obtained by drying over concentrated sulphuric acid and consequent heating at red heat and white heat) had been pulverized after previous drying over concentrated sulphuric acid. These 3 grams required 7 (seven) months in order to give off all water they were able to give off over concentrated sulphuric acid (mono-hydrate.) At last, when the weight was constant, the composition was found to be 4 SiO_2 , 5 CaO , $4 \text{ H}_2 \text{ O}$.

All of you will have observed that sometimes years pass before shrinkage cracks become visible in cement sidewalks or floors, and that these widen and increase in number from year to year. This serves to demonstrate how slowly the colloidal ground mass loses its water. The only way to counteract the shrinkage process in cements exposed to air is, besides using lean mortars, to gauge the mortar with as little water as practically possible.

It will certainly require some study yet in order to explain all features that can be observed with hydraulic cements; but, in my opinion, the characteristic and essential part of the hardening process has been revealed herewith; I really can no longer see anything obscure.

After having listened to the foregoing no one will be able to contend that the same cement which results in a hard stone, when gauged with little water and left to rest forms a colloid, a hydrogel when stirred with much water and when kept in agitation, and that the formation of the hydrogel is a characteristic property of cement. Furthermore no one can contend that the colloids of Portland cement and of slag cement, which I showed you by expelling

of all swelling water can be transformed into a stone as you have seen in the form of the eternite slab, or that this artificial slate has originated from colloidal Portland or slag cement. The compression strength of the hydrogel amounts to next to nothing but that of the stone obtained from it by compression is as high as 15,000 pounds per square inch. These facts are indisputable.

The deduction which necessarily follows from this is that the hardening of all hydraulic cements is mainly based upon the formation of a gel and that the hardness and resistance of the gel, if we do not consider the process of crystallization, depends upon the solidification of the gel particles and upon the original density of the cement.

Now, if you please, in what can my deductions be faulty?

That it required 150 years, if I go back as far as to Smeaton's experiments in order to rightly comprehend the hardening process, is to be explained by the fact that formerly the existence and behavior of colloids were rather unknown and that our knowledge of colloids is even now still in its infancy. Investigators invariably approached this subject with the assumption that the reactions go on according to well-de-

fined stoichiometrical proportions, that the elements always combine in integral parts, and that this problem can be solved without leaving a remainder; but the varying composition of the colloidal calcium hydro-compounds is in contrast to that; there were always remainders left; to-day reactions went one way and to-morrow another, and in order to mention only an apparently quite insignificant factor, experimenters used too coarsely ground substances. If you try to make subtle reagents act upon grains so big that they just pass a sieve of 4,900 meshes per square centimeter (200 mesh sieve) you cannot expect correct results, because the core of so large a grain will be imbedded in hardening colloids which form on its surface, and which are almost or even entirely impervious. Therefore the inside of the grains will not be reached by the reagents and will remain unchanged, it may be forever, but at least for a very long period. The experiment, therefore, must result in failure.

Gentlemen: The day has dawned when every phase of the hydraulic hardening process will be elucidated, and when we will reach the object for which we have labored so long. I wish to thank you for the attention and interest you have shown me.

INCORPORATED.

The Oklahoma Cement Products Co. has been organized by Minneapolis parties named below and H. E. Wilson of Wilson Blain Co., Oklahoma, who owns 320 acres of mineral land carrying limestone, clay and gypsum which has been taken over by the company of which C. F. Hoglin is Pres., Alex. Campbell Vice Pres., E. G. Patter (ex state senator), Secy.; H. N. Leighton, Treas.; all of Minneapolis. The company propose to make cement, pulp plaster, brick, plaster paris, etc.

The Great Western Cement Co. has awarded the contract for the construction of its plant to the Pennsylvania Engineering Co. It will be located near Bayard, Allen county, Kans., northeast of Iola. The company has drilled for gas on its own holding but so far gas has not been found. The Kansas Natural Gas Co. will furnish fuel to the company until they can develop a supply of their own.

The White Cliffs Cement Co. otherwise known as the Southwestern Portland Cement Co., is to be overhauled providing the American and Holland capitalists come to an agreement on the basis of each party furnishing one-half of the funds required. This plant has a first class equipment of kilns and machinery on the European plan or system of manufacture with an almost unlimited supply of chalk. The company has been repeatedly reorganized and the plant over-

hauled time and again, but never to conform to a strictly American system of cement manufacture, hence the plant has never paid expenses.

Perkins Portland Cement Co., Salt Lake City, Utah. President, Walter K. Perkins; Vice President and General Manager, E. D. Hashimoto; Secretary, John M. Bowman; Treasurer, Herbert M. Wells; Supt., S. B. Edy. Capital \$500,000. The plant will be located at Salt Lake City.

A charter has been granted by the Kansas States Charter Board to the Guthrie Mountain Portland Cement Co., of Kansas City, capital \$2,000,000. The officers of the company are as follows: L. C. Lehman, Jefferson City, Mo., Pres.; D. M. Colbern, Vice Pres., and L. A. Truman, secretary, all of Kansas City, Mo.

The Ash Grove Lime and Portland Cement Co., a Maine corporation has been granted permission to transact business in Kansas. Principle office at Chanute, Kansas. Capital \$2,750,000. The officers of the company are W. B. Hill, Pres.; O. J. Hill, Vice Pres.; J. F. Pollack, Treas.; all of Kansas City, Mo., J. H. Barton, Ash Grove, Mo., secretary. The Kansas franchise costs the company \$1,425.

J. C. Fisher has been granted a franchise for the erection of a cement plant at Okene, Oklahoma, of

which the capital is to be \$1,000,000. Another cement company is being organized at the same place.

The Sugar City Cement and Brick Co., of Sugar City, Fremont county, Idaho. The promoters are Thomas R. Cutler, Jr., D. W. Rorkey and T. C. Holtz all of Sugar City except Mr. Holtz who is from Idaho Falls.

The Concrete Engineering Co. of Davenport, Ia., capital \$10,000. C. W. Major, Pres.; R. C. Graham, Sec'y; to engage in plain and reinforced concrete construction.

The W. G. Haskell Coal, Coke and Cement Co. of Cedar Rapids, Iowa, capital \$15,000 all paid up.

Several Toronto capitalists have organized the Ben Allen Portland Cement Co., Ltd., which will erect a Portland cement plant at Ben Allen near Owen Sound, Ontario, and on the Grand Trunk Ry. The company is capitalized at \$500,000 of which \$60,000 has been subscribed by local Owen Sound parties. The plant is to have a capacity of 600 barrels per day to be increased to 1,000 barrels per day in the future. The cement industry in the Owen Sound district is assuming large proportions. The companies now there include the Owen Sound Cement Co. at Shallow Lake, The Sun, Grey and Bruce, and Imperial at Owen Sound which have a combined capacity daily of nearly 3,000 barrels.

The new cement plant to be erected at Harvey, Marion county, Iowa is to be known as the Hawk-eye Portland Cement Co.

The Wahsatch Portland Cement Co., of Jersey City, N. J., has been incorporated, capital \$1,500,000. The incorporators are Wendell P. Hurlburt, Herbert S. Drake, F. J. Randolph, Ellis E. Beebe and Joseph Kelley.

American Cement and Oil Company, Chicago; name changed to Excelsior Motor and Manufacturing company; capital increased from \$20,000 to \$60,000.

The Occidental Portland Cement Co., has been incorporated at Trenton, N. J., capital \$2,000,000. The incorporators are H. O. Coughlin, L. H. Gunther, J. R. Thompson, all of Jersey City, N. J.

The Greenbrier Portland Cement Co. of West Virginia, incorporated by Samuel Dixon, W. B. Calder of MacDonald, W. Va., A. D. Preston of Berkley W. Va., and R. J. Slegall of MacDonald, capital \$3,000,000.

The Van Dorn Portland Cement company has been chartered at Shreveport, La., capital \$1,250,000, J. L. Means, Pres. of Shreveport, W. J. Bayersdorffer, Treas.

The North American Portland Cement Co., has been looking up raw cement material in various parts of the country, with the view of locating several new cement plants at favorable distributing points.

Incorporated, the Best Brothers Keens Cement Co. of Cleveland, Ohio, capital \$100,000. Incorporators are G. W. Collister, A. J. Halle, John A. King and John Sherwin all of Cleveland, Ohio.

The West Coast Portland Cement Co. of Seattle, Wash., capital \$500,000. The company propose to erect a plant at the juncture of the Snake and Ronds rivers, partly in Idaho and partly in Washington. J. M. Edwards of Lewiston, Idaho, is the promotor. Seattle capitalists are in the enterprise. \$280,000 has been subscribed and is available for the purchase of machinery and material for the plant.

The North American Portland Cement Co. through A. F. Gerstell, Vice Pres. of the company, has

purchased 400 acres of land near Bellevue, Mich., carrying lime rock suitable for raw cement material, similar to that used by the Burt Portland Cement Co. of the same place. A large cement plant is to be erected on the land.

John B. Lober and W. R. Dunn of the Vulcanite Cement Co. and the Vulcanite Limestone Co., have been looking over a tract of land in North Annville, Lebanon Co., Pa., adjoining their present holdings with the view, it is said, of increasing the company's holding in limestone deposits in that vicinity.

The Oklahoma Portland Cement Co., of Kansas City, Mo., has been incorporated under a West Virginia charter with a capital of \$3,000,000—\$30,000 paid in. The incorporators of the company are as follows: Wm. Peet, J. H. Harrington, C. C. Courtney, W. D. Vickers, all of Kansas City, Mo.; J. D. Robinson, Independence, Kan.; O. S. Johnson, Chanute, Kan.; Jacob Geiger, John S. Logan, Chas. Geiger, John E. Dolman, Andrew Hank and J. M. Heller all of St. Joseph, Mo. The company expect to build a plant in the Indian Territory.

The Lumberman's Portland Cement Co. has been incorporated under the laws of Kansas, capital \$2,500,000. The company has secured a large acreage of gas land near Carlyle, where the plant will be located. S. F. Grizner of Iola, Kan., and E. S. Slough of the same place are interested parties.

The Southwestern Cement Manufacturing Co. of El Paso, Texas, has been organized to erect a plant at El Paso on part of the land purchased from the El Paso Smelter Co., just west of the city. The officers of the company are as follows: Carl Leonard, Pres., of Los Angeles; A. Courchesne, Vice Pres., of El Paso; O. J. Benford, Secy., of El Paso, late of Los Angeles; J. F. Williams, Treas.; A. Moore of Ogden, Utah, and others are interested.

The Harvey Portland Cement Co. of Harvey, Iowa, has commenced quarrying rock to be used in the foundation for the building.

ORGANIZED.

The Muskegon Portland Cement Co. of Muskegon, Mich., capital \$1,000,000 of which \$200,000 is claimed as paid in. W. J. Reynolds

Pres. of Muskegon, A. G. Thompson, Cice President of Chicago, I. Preston Barnett secretary of Chicago, John W. Wilson treasurer of Muskegon, Chas. P. Abdill assistant treasurer, Chicago.

The company propose to locate a plant near Holton, Muskegon county, Mich., where there are several lakes having extensive marl deposits.

C. S. Leeds, Pres. of the Ajax Portland Cement Co., visited the proposed site of the plant known as the Gurnsey Farm, 6 miles north east of Independence, Kan. The details for the construction of the plant have been settled and arrangements for sidings from the Santa Fe Ry. to the site of the plant have been concluded with the railway company.

The Eldred & Palmer Co., Cold Spring; manufacture cement etc.; capital \$6,000. Incorporators: Byron E. Eldred, 208 Fifth Ave., L. M. Palmer Jr., 249 Broadway; H. M. Brigham, 37 Liberty St.; John Mack, 56 Beaver street, New York; and E. V. Nelson, Cold Spring, New York.

BLACKMAILING CEMENT PLANTS.

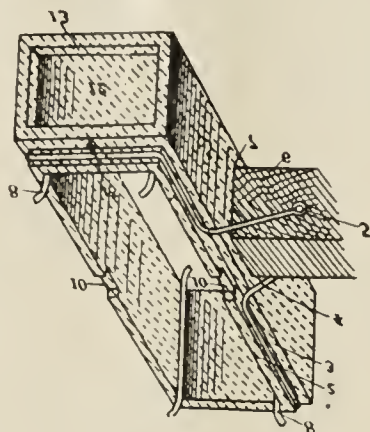
A gang of Italian Black Hand desperadoes have been trying to blackmail cement companies in Lehigh and Northampton counties, Pa., by threats to dynamite the plants and murder the managers unless certain sums of money were paid to the gang. Some of the companies paid over the money. Chas. A. Porter, manager of the Lawrence Cement Co., was assessed at \$10,000 by the gang which he refused to pay. An Italian detective agency was employed to ferret out the matter which they did, causing the arrest of eleven members of the gang. The leader, Guiseppe Paul, confessed in hope of receiving a light sentence. The three men who were to do up Mr. Porter left for California where they were arrested. 150 of the gang were forced to leave on short order. The leaders of the gang were located in New York, Philadelphia, Pittston, Allentown, Cementon, Siegfried, Reading and Scranton.

GLASS BRICK.

The Adler (Eagle) Glass Co. of Penzig, near Gorlitz, Germany, manufacture glass bricks under the Falconier and Garchey patents. They also make glass bottles. 700 men are employed. An 8 per cent. dividend was declared for 1906.

U. S. PATENTS RELATING TO CEMENT AND CONCRETE.

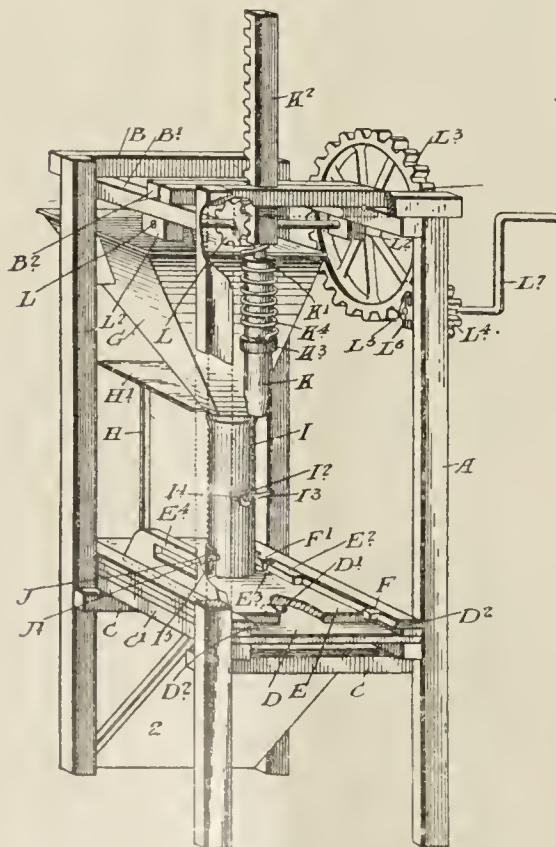
859,947. Reinforced Concrete Building-Block. Solomon M. Kemp, Baltimore, Md. Filed Oct 6, 1906. Serial No. 337,687.



No. 1.

1. The combination of a reinforced concrete building block substantially as hereinbefore described, provided with a hollow end portion and an opening in the side wall thereof, of an extension and shoulder on the top part of the said block, of a metal band secured around the said extension, of a cut away portion in the extension, of a metal rod reinforcement secured in each corner of the block, of an extension on the opposite end of said block and adapted to fit into the opposite hollow end portion of a similar block whereby they may be secured together, for the purpose as herein set forth.

860,000. Concrete-Tile-Making Machine. William Wettlaufer, Stratford, Ontario, Canada. Filed March 26 1907. Serial No. 364,604.

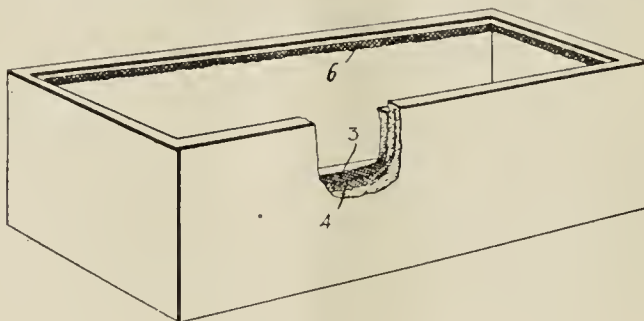


No. 2.

A tile making machine comprising a table having a hole therein, a slidable table thereon having a hole therein adapted in one position to register with the hole in the

first table, a mold surrounding the hole in the slidable table carried by said table, a hopper adapted to deliver material to the mold, a cut off plate for the hopper carried by the slidable table, a reciprocating plunger, and means for reciprocating the plunger through the mold and registered holes to force the core from the mold.

860,184. Method of Constructing Cement Burial-Vaults. Seth W. Beckwith, Toledo, Ohio, assignor to Charles Baker, Toledo, Ohio. Filed June 28, 1906. Serial No. 323,793.



No. 3.

1. The method of constructing vaults consisting in applying wire cloth to a removable form, applying cement to the outer surface of the wire cloth, permitting the same to dry, removing the form and applying cement to the inner surface of the wire cloth and permitting the same to dry.

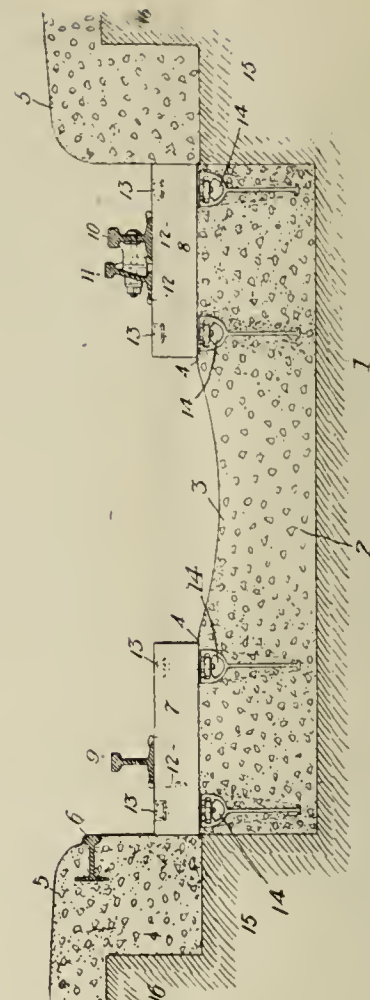
2. The method of constructing vaults consisting in applying wire cloth to a removable form, applying cement to the outer surface of the wire cloth, permitting the same to dry, removing the form and bending the upper edge of the wire cloth inwardly, and applying cement to the inner surface of the wire cloth and beneath said inwardly bent portion.

860,558. Railway-Track Construction. Henry B. Nichols and George B. Taylor, Philadelphia, Pa. Filed March 2, 1906. Serial No. 303,852.

1. In railway track construction, a monolithic composition supporting body, an anchor having a hollow head and embedded in said body, a rail supported on the monolith, and securing means for the rail attached within the hollow head of the anchor.

5. In railway track construction, monolithic composition supporting body, anchor-irons or girders having longitudinally slotted heads, nuts within said heads, rails upon the monolith, and bolts for securing the rails to said nuts through the slots.

860,685. Method of and Apparatus for Burning Cement. Thomas M. Morgan, Longue Pointe, Quebec, Canada. Filed Feb. 7, 1906. Serial No. 299,856.



No. 4.

1. A method of burning cement which consists in injecting a quantity of inflammable gas into a revolving cylinder and imparting a swirling motion to said gas by means of a jet of air or stream discharged across the mouth of the cylinder.

3. A method of burning cement which consists in injecting a stream of gas or finely powdered coal into a revolving kiln, igniting said stream at the mouth of the kiln, and imparting to the flame of combustion a swirling or revolving motion by discharging jets of compressed air or steam across the mouth of the cylinder at right angles to the inflow of gas.

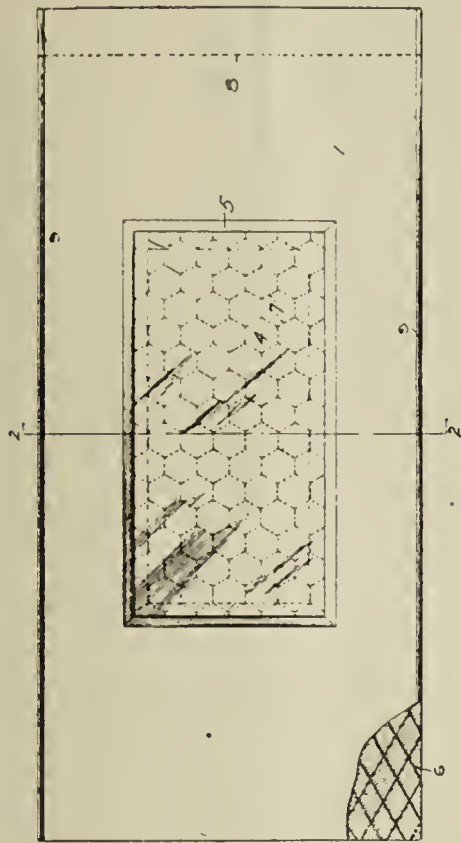
4. A method of burning cement, which consists in injecting a stream of inflammable gas into a revolving cylinder, igniting said gas at the mouth of the cylinder, and discharging a jet of compressed air or steam downwardly across the mouth of said cylinder at right angles to the inflow of gas, but out of the line of impact with said gas, to thereby prevent cold air from entering the cylinder from below and to impart a swirling motion to the flame of combustion.

860,796. Cement Tile with Light-Pane. Ignatz H. Freund, Beaver, Pa. Filed Dec. 3, 1906. Serial No. 346,089.

3. An illuminating tile comprising a thin cement slab provided with a large opening having a rabbet surrounding the same, and a sheet of glass resting on said rabbet, a portion of the cement body

being molded over the outer surface of the glass.

861,241. Portland Cement and Process of Manufacturing the Same. Thomas A. Edison. Llewellyn Park,



No. 5.

Orange, N. J. Filed June 28, 1904. Serial No. 214,466.

1. As a new product, crushed Portland cement having no appreciable proportion of ground particles, substantially as set forth.

2. As a new product, crushed Portland cement having no appreciable proportion of ground particles and in which the larger bulk is coarser than "flour" and finer than the tailings of a 200-mesh screen, substantially as set forth.

3. As a new product, crushed Portland cement having no appreciable proportion of ground particles and in which more than 80 per cent of the particles will pass a 200-mesh screen and less than 10 per cent of the mass is in a condition of "flour," substantially as set forth.

4. The process of making Portland cement, which consists in subjecting the clinker to a single unitary crushing operation, whereby the particles are crushed as distinguished from being reduced by grinding, substantially as set forth.

5. The process of making Portland cement, which consists in subjecting the entire mass of clinker successively to a crushing pressure, as and for the purposes set forth.

6. The process of making Portland cement, which consists in subjecting the clinker to a single unitary complete crushing operation, then in removing the sufficiently fine particles and finally, in recrushing

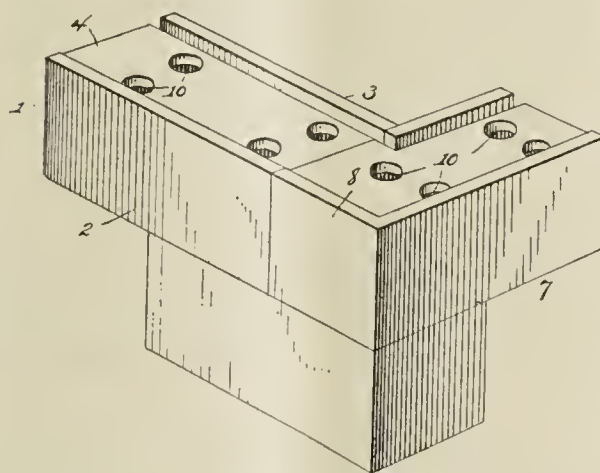
ing the tailings, substantially as set forth.

7. The process of making Portland cement, which consists in subjecting the clinker to a single unitary complete crushing operation, then in removing the sufficiently fine particles, and finally in recrushing the tailings with an added mass of fresh material, substantially as set forth.

8. The process of making Portland cement, which consists in subjecting the clinker to the action of a pair of powerful crushing rolls, then in removing the sufficiently fine particles from the tailings, and finally recrushing the tailings, substantially as set forth.

9. The process of making Portland cement, which consists in subjecting the clinker to a pair of powerful crushing rolls, then in subjecting the tailings to the effect of an air blast for removing the sufficiently fine particles, and finally in again returning the tailings to the crushing rolls, substantially as set forth.

861,348. Building-Block. Ferdinand Baltz, McMechen, W. Va., assignor of one-half to Adam Baltz, McMechen, W. Va. Filed July 18, 1906. Serial No. 326,791.

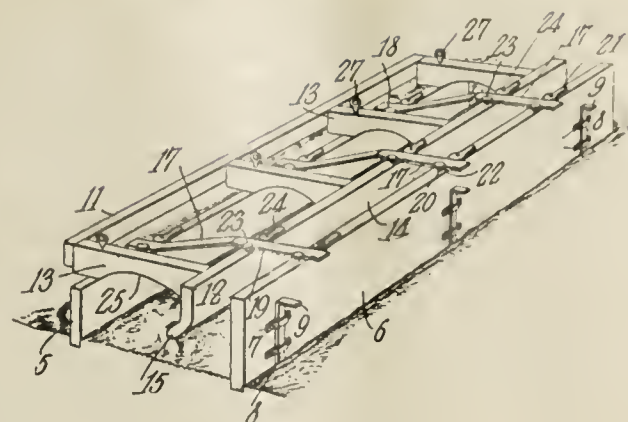


No. 6.

A building block formed of vertical faces, horizontal panels, a central panel connecting said horizontal panels and projecting beyond the ends of said horizontal panels, and terminating to the rear of the ends of the vertical faces.

861,686. Form for Making Concrete Curbs or Gutters. Charles E. Twitt, West Tampa, Fla., assignor of one-half to William J. Twitt, West Tampa, Fla. Filed Apr. 18, 1907. Serial No. 368,933.

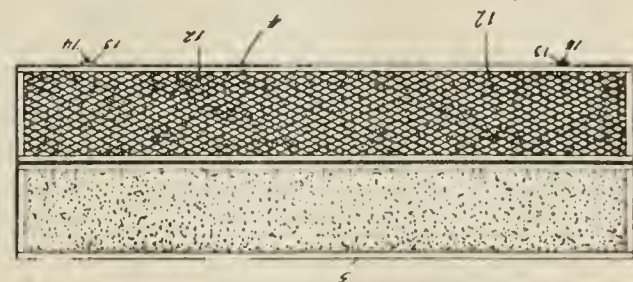
1. A mold including spaced longitudinal timbers of different heights and connected by transverse bars, a stationery frame supported on the timbers and having one longitudinal edge thereof bearing against the connecting bars and spaced from and disposed in horizontal alinement with the upper longitudinal edge of the highest



No. 7.

timber to form an intermediate molding compartment, and impaling members slidably mounted on the exterior faces of the longitudinal timbers and adapted to be embedded in the ground.

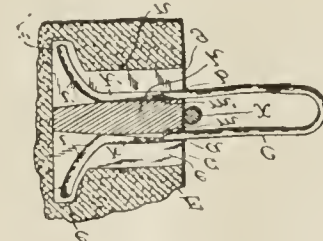
862,440. Method of Manufacturing Concrete Blocks and Slabs. Oscar Bradford, Chicago, Ill. Filed July 20, 1906. Serial No. 326,988.



No. 8.

2. The improvement in the art of manufacturing reinforced concrete slabs or blocks, consisting in filling two half molds with the plastic cement, then placing a metal reinforced sheet upon the concrete of one half mold, then putting the open faces of the half molds together, and retaining them in contact until the concrete has set.

862,522. Composite Fence-Post. Ellis T. Silvius, Indianapolis, Ind. Filed Feb. 27, 1905. Serial No. 247,478.



No. 9.

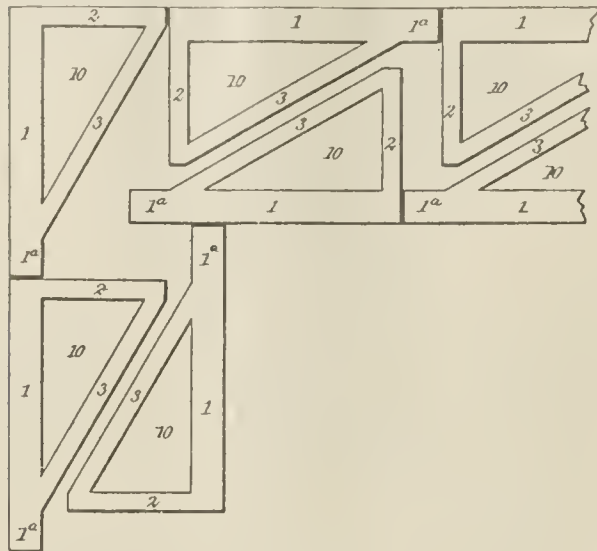
1. A concrete fence-post provided with embedded fence fastener holders held removably in the fence-post and having each an opening therein to receive a fence-fastener.

2. A fence fastening device comprising a plurality of parts having grooves therein to form sockets, the parts co-operating one with another, co-operating wedge-shaped key part, and means for binding all the parts together.

863,435. Building-Block Howard L. Pegram, Mulvane, Kans. Filed July 25, 1906. Serial No. 327,633.

1. A course of building blocks

having end plates, back plates extending diagonally therefrom, and side plates formed at a right angle to the end plates and extending beyond the back plates, arranged in



No. 10.

reversely disposed inner and outer series to form wall faces with transverse air passages between the extended ends of the side plates of adjacent blocks of the inner and outer series and diagonal air spaces communicating between the back plates of adjacent blocks of the inner and outer series, substantially as shown and described.

WHALE SKIN LEATHER.

A tough durable leather is now made from the skin of whales. It is used for covering furniture and buggy tops and making boots and shoes. A single skin produces about 1,500 square feet of leather which weighs from 2 to 5 ounces per square foot. Leather is likewise made from the intestines of whales which resembles kid. It is thin and tough.

A shortage of cars caused by the shutting down of the Great Northern Portland Cement plant, which was in the hands of the receiver after \$75,000 had been expended to convert the plant from marl to the rock process, the rock being shipped by rail from a point near Charlevoix to Marlboro. The Pere Marquette Ry. were unable to furnish cars to ship the stone required. The output of the plant was 1,200 bbls. per day. There is some talk of the plant being sold to a new company with a capital of \$1,000,000. The new company propose to increase the capacity to 3,000 barrels per day. Mr. Pritchard, the late general manager of the plant, is preparing the plants for remodeling the works for the intending purchasers.

E. P. Doak who owns a large tract of land on the Pitts and McCloud rivers north of Redding, Shasta county, California, is reported to be considering the building

of a cement plant in land owned by him, known as the Lime Buttes, which is about 3 miles up the McCloud river from its junction with the Pitt river. The project includes the construction of a short railway from the site of the proposed plant to connect with the Sacramento Valley and Eastern Ry., which follows the Pitt river.

The Ideal Concrete Machinery Co. of South Bend, Ind., is offering \$200 in prizes for the best 8 by 10 photographs showing the most artistic buildings constructed of Ideal Concrete Blocks. First prize \$100, second prize \$50, third prize \$25.00, fourth prize \$15.00, fifth prize \$10.00. Detailed description of the buildings must be given on blanks furnished by the company.

We have reviewed the July issue of The Printers Art of Boston, Mass. This is certainly the perfection of the art of printing and it is refreshing to glance through its pages and examine minutely the numerous illustrations, all of which are little gems of art suitable for framing. The publishers of the Printers Art are to be complimented for their exquisite taste, displayed on every page of their journal, which few can equal.

CEMENT INDUSTRY.

Kansas City is at the present time, the seat of greatest activity in cement industry in the United States. No less than twenty-two Portland Cement Companies can be listed, all having headquarters in Kansas City. These are in various stages of promotion and development. Many exist only in name, whereas others are substantially founded and others are actually constructing plants. The interest being manifest in cement manufacture seems to be largely due to the fact that Kansas City, being at the same time a great railroad center is also a convenient point near the supplies of cheap fuel, such as natural gas and oil, as well as suitable cement material. — *Palmer's Monthly*, Kansas City.

UNIVERSAL PORTLAND CEMENT CO.

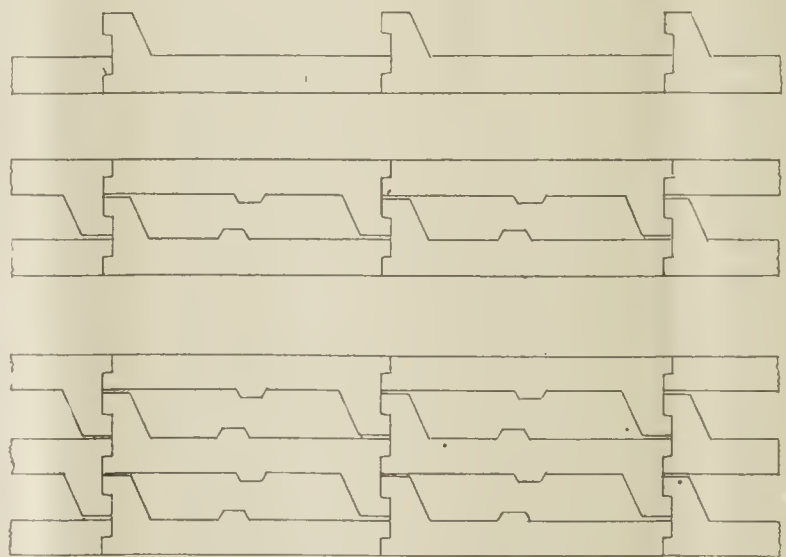
Chicago—Pittsburg.

ANNOUNCEMENT.—Chicago, August 1, 1907. Mr. C. J. Connell has been appointed Assistant Secretary in charge of Accounting Department. Mr. Frederick Blanchard has been appointed Credit Manager in charge of Credits and Collections. T. J. Hyman, Secretary. Approved: Edward M. Hagar, President.

FOR SALE

Two Piece Interlocking Concrete Block System

Including Patents and Patterns for the United States, excepting Cook County, Illinois. This is the only two piece block system that has been given general permit to erect buildings in Chicago, where numerous residence and factory buildings have been constructed. One piece, two piece and three piece walls can be constructed on this system.



The patterns include cornice, belt courses, porch columns, chimney blocks with numerous face plates. This system can be used in the form of a single shell interlocking with the wooden framing producing the most economical veneered concrete facing in existence. Address,

Box 74, care of Cement & Engineering News

Marcus Pluth of Victorville, California, claims to have secured Boston Capital for a Cement plant to be erected at Victorville, San Bernardino Co., California.

The Guthrie Mountain Portland Cement Co. which is to erect a cement plant near Fort Scott, Kans., has commenced to lay a pipe line from the gas field to the proposed site of the plant.

"An order has been placed through Messrs. Westinghouse, Church, Kerr & Co., of New York, with the Bradley Pulverizer Co. for Griffin Mills for the equipment of the entire grinding plant of the 3,000 barrels per day Portland cement works now being erected by the Ajax Portland Cement Co., Independence, Kansas. This order was placed after a thorough and exhaustive investigation by the expert engineers of Messrs. Westinghouse, Church, Kerr & Co., of all the different investigation they recommended the Griffin mill to their clients as being in their opinion the best mill on the market for use in cement works."

FOR SALE.

Patents of American Hydraulic Stone Co. for two piece hollow box system and of the Perfection Machine for use in columns, etc., for the City and County of St. Louis, together with machine forms and all other implements necessary for immediate commencement of the work. Address W. H. Swift, 905 Chemical Building, St. Louis.

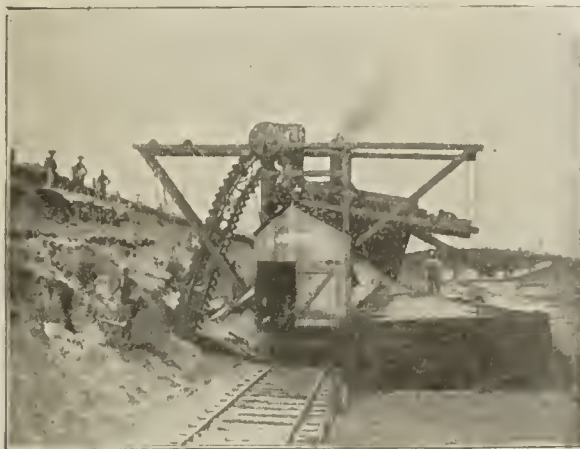
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Address L. 3. care Cement and Engineering News, Chicago, Ill.

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Clarinda, Iowa, Dec. 17, 1906.

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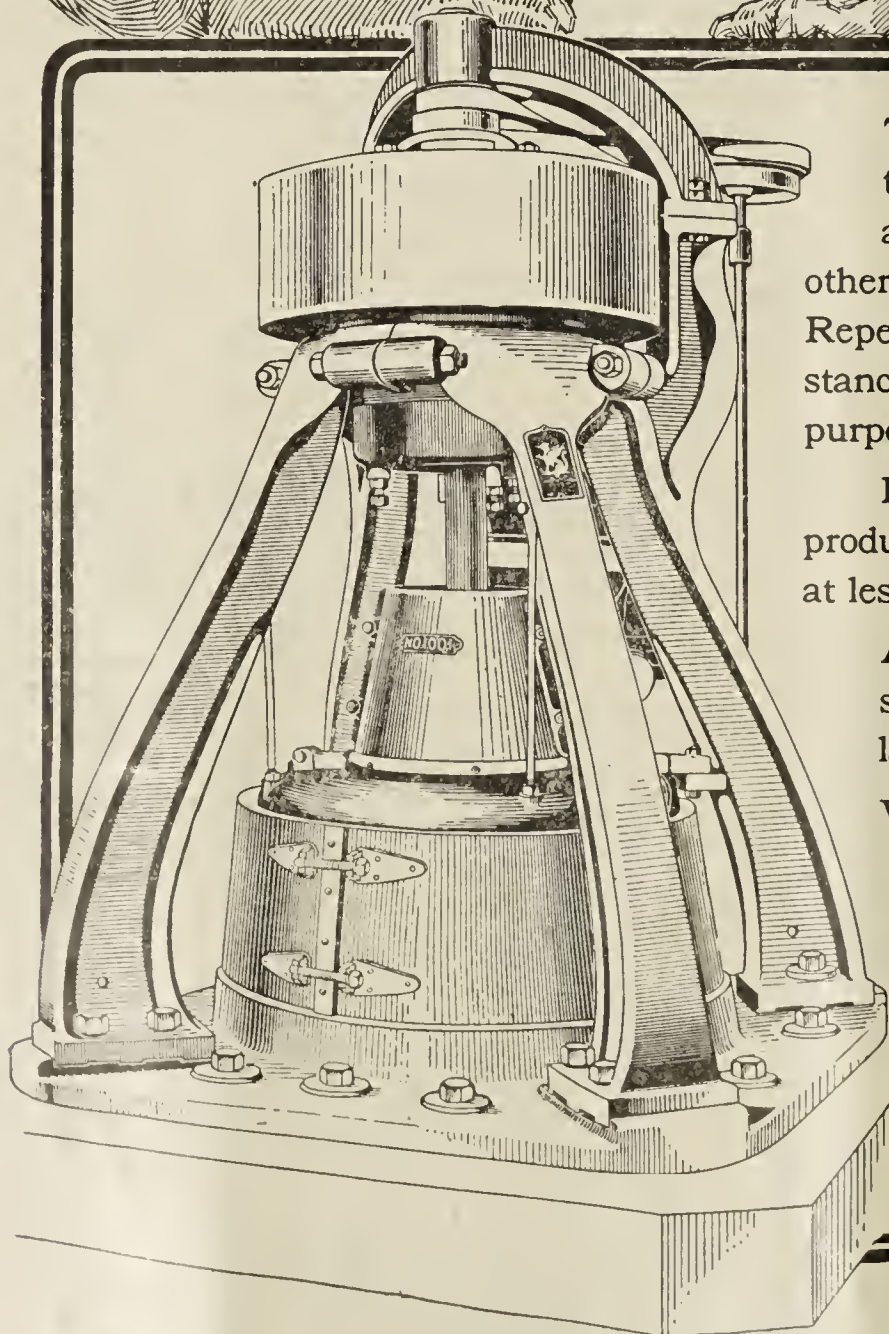
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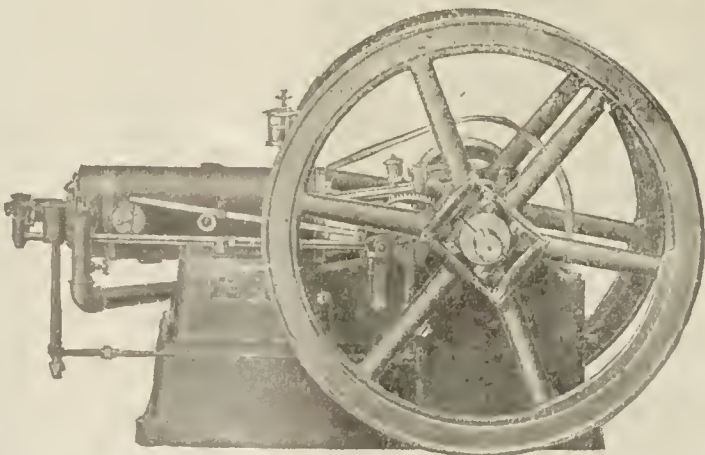
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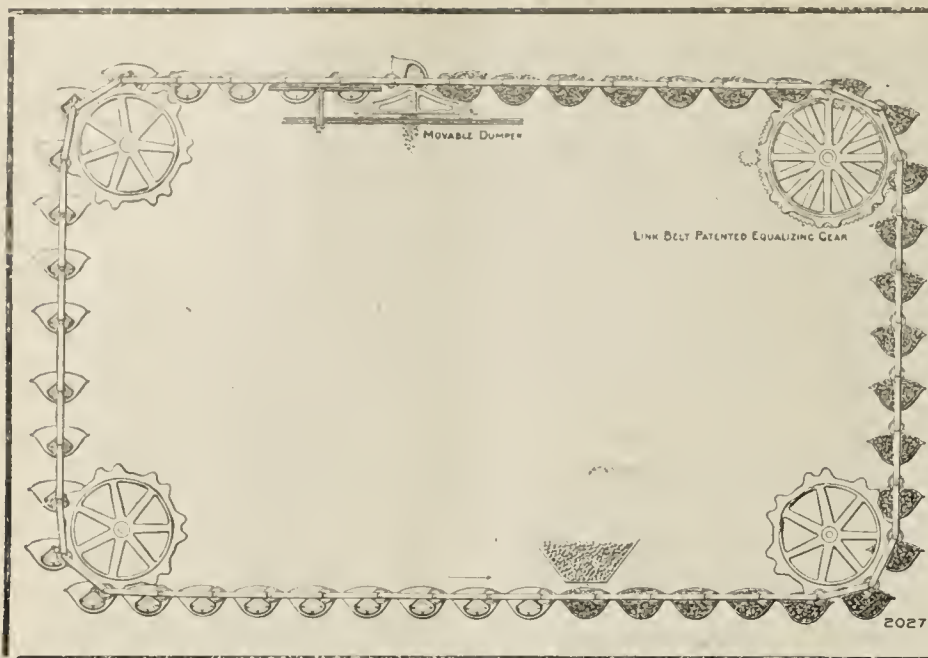
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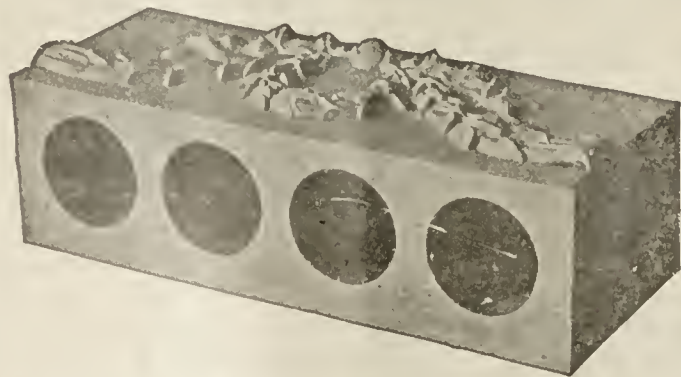
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WILLIAM SEAFERT, Editor and Publisher

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CHICAGO, SEPTEMBER, 1907.

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RESTRICTING THROUGH FREIGHT BILLING OVER NEW YORK RAILWAYS.

The Cayoga Lake Cement Co. of Ithaca, New York, will be compelled to operate a line of boats in order to make deliveries of its product to points not on the lines of either of the two railways entering Ithaca, as these roads refuse to permit their cars to go upon the tracks of other roads. This prevents through billing of cement to its customers on other roads. The Erie, New York Central and Lackawanna have adopted the same policy. In order to reach the market, the Cayoga Cement Co. will purchase or build a fleet of canal boats, steam and tow barges, and ship its cement to its warehouses at Buffalo, Utica and Syracuse, from which points it will be reshipped to its customers by rail. One warehouse has already been established at Rochester where about 6,000 bbls. of cement per month have been shipped during the present season. Cement plants and other large producers not located upon the water route will be confined to restricted market. The freight traffic has doubled during the past ten years while the railways have increased their facilities only ten per cent. This makes the railways indifferent to the needs of the shippers. Car shortage has been the rule in many parts of the country during the past few years. We believe that the selfish policy of the railway companies in ignoring the vital interests of the producers will be remedied by legislation in the near future. Should this policy of restricted billing be strictly en-

forced it would be equivalent to confiscation of many large industrial plants located on the line of the railways adopting this policy. It seems strange that while all railways offer inducements for industrial plants to locate on their individual line, that they should adopt a policy that can only work injury to all concerned. It is certainly a bad business policy.

The same policy has been in force on some of the western roads centering at Chicago. The trouble is caused by the roads not having sufficient rolling stock to take care of the traffic which originates on their own lines. Even to the belt lines which connect with all the roads entering Chicago, one of the Chicago belt line roads is building its own cars in order to protect the interests of industries on its lines, which cars can be used only in restricted areas.

CEMENT CONSTRUCTION.

The remarkable rapidity with which reinforced cement construction is being applied in the erection of manufacturing plants, warehouses and other business structures in this city is looked upon with considerable alarm by the big brick manufacturing concerns as well as by bricklayers and stonemasons. There are so many advantages claimed in favor of this mode of construction from the standpoint of durability and economy that in all sections of the city the wooden framework used has become so common a sight as to be no longer an object of any interest. It has been calculated that nearly \$10,000,000 is now being expended in Philadelphia for concrete buildings.

How greatly this method of construction is affecting brick manufacturers and bricklayers is well illustrated in the erection of a certain factory uptown, which was originally planned to be erected of brick, of which 3,000,000 would have been required. The owners subsequently decided to use the reinforced system of construction, with the result that but 300,000 bricks were required, and these only for the exterior work.

When the number of such buildings in course of construction is considered and the further fact that the statistics for this year show so far a falling off of more than 1,000 dwellings, it is easily calculated that the output of bricks in this city for construction will show a falling off of nearly 100,000,000 this year. Nearly all the brickyards are carry-

ing big stocks at the present time, while a few years ago at this season the demand was far greater than the supply. This reduction in demand is expected to produce a gradually lower price in this commodity.

Probable Effect on Mechanics.

The same condition of affairs will likely take place in the building trades, so far as bricklayers and stonemasons are concerned. These mechanics are now facing a condition of affairs where work will become scarce, and as a natural consequence in the course of time wages will become lower. On the other hand, cement construction, by reason of the necessity for false work, which provides the moulds in which the concrete is laid, has created a demand for carpenters, and this class of mechanics is very much in demand, and to such an extent that they are now demanding and getting pay at the rate of 47 1-2 cents an hour.

CONCRETE COUNTRY RESIDENCES.

10x12 $\frac{3}{4}$ in. 168 pages. Price, \$1.00. Published by the Atlas Portland Cement Co., 30 Broad St., N. Y. Price, \$1.00.

This is one of the handsomest books ever published on the subject of cement building construction. The illustrations show the progress made in artistic concrete buildings, especially in fine country residences, and out buildings, connected with country seats, all designed by first class architects, many being for clients with unlimited means, who could just as well build in marble or granite, yet have chosen concrete construction for their country homes. The floor plans of each building are drawn on a liberal scale which makes the work valuable as a book of modern house plans ranging in cost from \$2,000 or less up to \$50,000, or over. Any one intending to build should send \$1.00 for this elegant publication, which covers almost every kind of concrete construction including plastered finish on metal lath, concrete block, solid monolith and reinforced concrete, always of the best type and class in each case.

CEMENT IN PARAGUAY.

U. S. Consul John N. Ruffin of Asuncion, Paraguay, reports the price of cement in that country at one dollar and five and one dollar and ten cents per barrel of 240 pounds net, on account of low water in the Paraguay River it rose to \$5.90 per barrel in March, 1907.

PATENTS, THEIR INFLUENCE ON PRODUCTION.

By Edwin J. Prindle, M. E., L. L. M., of the New York Bar, New York.

Four important papers, by Edwin J. Prindle, of the New York Bar, which have been made up in pamphlet form from the original articles in *The Engineering Magazine*, form a valuable contribution to the literature of patent law, and on account of their great interest to technical men in general, they demand more than a passing notice.

The titles of the papers are as follows:

I. Their Influence in Making Markets and Commanding Success.

II. What Protection a Patent Affords.

III. Patent Knowledge Needed Before Issuing a New Product.

IV. Patent Relations of Employer and Employee.

After stating that patents have been one of the most important factors in the growth of the United States from a group of poverty stricken, non-manufacturing dependencies to the greatest manufacturing country in the world, the writer mentions a number of large manufacturing companies in the United States as prominent examples of the efficient use of patents in controlling competition, and building up a large business. As showing the attitude of the courts towards patents, a recent decision to the following effect is quoted:

"Within his domain, the patentee is czar. The people must take the invention on the terms he dictates or let it alone for seventeen years. This is a necessity from the nature of the grant. Cries of restraint of trade and impairment of the freedom of sales are unavailing, because for the promotion of the useful arts the constitution and statutes authorize this very monopoly."

The object of the papers is not to make the manufacturer his own lawyer, but to give him a better idea of the nature of a patent; of the protection it affords; of the great adaptability of patents to different commercial conditions and forms of transactions; of some of the many ways in which the courts will thwart attempts to get the benefit of an invention without the consent of the patentee; of what must be known to the patents of others when putting out a new product and of how to secure a monopoly of such product, if that is possible; and of the line between the manufacturer's rights and those of his employee.

Different Kinds of Inventions.

There are four different classes of

inventions for which patents are granted. First: Arts or processes, which are any series or steps of operations for accomplishing a physical or chemical result; for instance, the art of casting car-wheels which consists in causing a jet of molten metal to enter the mould in a tangential direction to give the metal a whirling motion, so that the heavy, sound metal will flow to the rim of the wheel and the cinders and bubbles will be displaced to the center and will thus not occur on the rim. The patentability of a process is not at all dependent on whether or not the apparatus by which it is carried out is new. The apparatus may also be patentable. The second class of inventions includes machines which include, broadly, any assemblage of elements having a law of action of its own. The third class of inventions, manufactures, includes everything made by the hand of man which is not in the second class, such as a knife or a pencil. The fourth class is compositions of matter, such as illuminating gas, a soap or a tool steel. The composition may be either a mechanical mixture or a chemical composition. A new combination of old elements is patentable if it produces a new or improved result, or an old result in a new way. A new form of an element of a combination that is old as a whole may be patentable. Improvements and additions to old machines may be patentable. Even a new use of an old device, machine or process is sometimes patentable.

The Rights of a Patentee.

A patent gives the patentee the right to exclude everyone else from making, using or selling his invention. If, however, his invention happens to embody the principle of some invention that is covered by a previous patent even though the latter patent covers a much improved device, the owner of the previous patent, while his patent is in force, can prevent the making, using or selling of any embodiment of the latter invention using the earlier principle, but the earlier patentee can be prevented by the later patentee from making the improved form of the invention.

The measure of the grant of the invention is determined by clauses at the end of the patent, which are termed "claims." There is no piece of English composition that is more generally misunderstood than the claim of a patent. Many people suppose that the more a claim says, the more it covers, while paradoxically the less it says the more it covers. This is made clear by a series

of examples of claims which cannot be here repeated. The matter is also illustrated by likening a claim to a bill of sale giving title to cattle on a large Texas ranch. These must be read in full to be appreciated. If it were to give title to "all the short-horn Durham steers having one white forefoot and three red feet," the purchaser would get very few cattle. If, however, the bill of sale gave title to "all the live stock" on the ranch, the purchaser would not only get all the short-horn steers with only one white foot, but he would get all the steers of every description, and all the heifers, bulls, horses and pigs that might be there. What a claim should do is to seek to cover only so much of the particular embodiment of the invention shown in the patent as is essential to the practice of the invention, and to leave out all details which can be omitted or varied without departing from the principle. The claim is said to be like giving one title to everything that can be found that will fit into a box. Now, if no particular kind of a box were specified, the grantee would have a very valuable monopoly. Everything that would go into a square, or a round box, or an oval box, or a star-shaped box would be his. But if the box were stated to be a "round box having a pin set up in the center of its bottom and extending up to a level with the top of the box," it is evident nothing could be put into the box but round things having a hole through the middle, and the grantee would have a very much less desirable monopoly.

The patent grants the right to exclude all others from making, using or selling the patented article. These are the only ways in which an invention is capable of commercial enjoyment. Each of these three ways is a separate monopoly, and may by proper instruments be granted or sold separately. For instance, the patentee of a machine could grant to a manufacturer exclusive right to make the machines for him at a stipulated price and could prevent him from using them or selling them to others. The patentee could then grant to a jobber the exclusive right to sell the machines, reserving proper compensation to himself, and the jobber could be prevented from either making or using the machines. The exclusive right to use the machines could then be granted to a given consumer, who in turn would have no right to make or sell machines. The right to make, or that to sell, or that to use, can be granted for certain

restricted territories instead of the entire United States.

For instance, a patentee of machines for making concrete building blocks sells his machines to one person only in each city or county, and neither the patentee nor anyone else can use machines of that kind in the given city or county afterward. The right to use an invention for each of several industries can be sold. For instance a patentee of a process of making watch dials, not only sold the exclusive right to make watch dials by that process, but he sold to a separate company the exclusive right to use the process in making enameled signs under the same patent. A patentee can grant the right to make a limited number only of machines, and the making of a larger number can regulate the length of time that a specimen of the invention is to be used, or the price at which the patented things are to be sold, and the quality of the materials to be used. The patentee can require that the materials used by the machine shall be bought only by him. He can lease the machine, retaining the ownership and requiring payment in royalties. Similar restrictions can be imposed upon the other classes of inventions. The manner is illustrated, by a variety of examples, in which a court will interpret the claim of a patent in determining whether or not a given machine complained of is an infringement. The broad principle is that a patentee is entitled not only to the specific form shown in his patent, or stated in his claims, but is also entitled to control the making, using or selling of every equivalent construction. This term, "equivalent" the courts have defined to mean every construction which performs the same function in substantially the same way as the elements of the claim. This is a rather elastic definition, but enables the courts to do equity, in that they give it wide scope in the case of an invention representing a substantial advance in the art, and give it a restricted meaning in the case of inventions which are only slight improvements. The courts can be induced to give the claim a restricted meaning where the one who is sued shows, by the prior art, that the invention was only a slight improvement in the art. If one of the elements of a claim is omitted, infringement of the claim is avoided.

Remedies for Infringement.

There are three remedies for the infringement of a patent. An injunction can be obtained, restraining the further manufacture, use or

sale of the patented invention. The damages which the patentee has suffered through lost sales can be recovered, and the profits which the infringer has made can also be recovered, although the burden is on the patentee of proving what the profits were.

There are three forms of direct patent protection which it is possible to use to obtain a monopoly of a new product, and one form of indirect protection. The first and best protection would be that of a patent on the product itself, in order to obtain which the product must have been the original invention of the applicant for the patent, and must have been invented before it was known or used by others in this country, and he must not have allowed more than two years to have elapsed after the first printed description of it has been published, before filing his application for patent. There are other requirements, but these are the most important ones. When the original patent on a product is about to expire, it is often sought to extend the monopoly by improving the product, and taking out a new patent. Under these circumstances, however, the new patent only covers the improvement, and the original form becomes public property, on the expiration of the original patent. This point, as are most statements made in the papers, is illustrated by concrete examples. If the product could be so greatly improved as to completely or largely supplant the old form, then a patent on the improved products would practically extend the monopoly.

The second way in which the product can be protected is to patent a process of making that product, by which the product can be made either of a quality that is superior to any similar product on the market, or by which it can be made cheaper than any other product of the same quality. If the process covers the only possible way of making the improved product, or the only possible way of making the product cheaper, a patent on the process is as good protection as a patent on the product itself, for it prevents competition. The patent on the product covers the product, whatever may be the process or machine used in manufacturing. The patent on the process covers the process, whatever may be the apparatus used in practicing the process. It is, of course, desirable to patent both the product and the process, if possible.

The third way of protecting the product would be to invent a ma-

chine or apparatus which would make a product of better quality or of less cost than those already on the market.

The fourth way to protect the product would be to tie it up with some other patent. For instance, there was a fastener for fastening buttons on shoes, on which fastener there was no patent. These fasteners were driven by hand tools. A machine was invented for driving these fasteners by the mere movement of a treadle, the machine being so simple that it could be sold to shoe dealers throughout the country, as well as to manufacturers. The button-setting machine was sold only under licenses which permitted its use only with button fasteners purchased of the manufacturers of the machine. These licenses were upheld by the courts, and the machine practically drove the hand-setting tools out of the market. Thus the patent on the machine practically gave a monopoly on the button fastener itself.

It is not sufficient simply to determine whether the new product, machine or process can be patented, but it is also necessary to have an investigation made to see whether there is any valid existing patent covering any principle or feature that is used in the new product, process or machine, because if the manufacture, use or sale of the new invention would involve the use of the principle of the prior patent, the prior patentee could enjoin the use of such invention. One does not acquire the right to use a patented invention by improving that invention enough so that the improver is entitled to a patent. He must either acquire the right from the earlier patentee to make the improved form, or wait until the earlier patent is dead.

Employer and Employee.

In treating the patent relations of employer and employee, three principal points are considered. First, who in the eyes of the law is the actual inventor of a particular invention; because a patent is valid only when granted in the name of the actual inventor. Mere ownership of the right to the patent, or the furnishing of money to develop it, does not entitle a person to patent an invention in his own name. Many an inventor, however, is not a mechanic, and many an employer, while able to conceive the principal features of an invention, may not be sufficiently practical to work out the details of the invention. If then, he employs some one else to work out the details, the employer is regarded by

the law as the inventor, and not the employe, and in case of a controversy between the two, the presumption is in favor of the employer, and the employe must show by convincing proof that he made the invention before his claim can be entertained. Several specific illustrations are given. In order that the employer may be regarded as the inventor by the law, it is necessary that he do more than merely to suggest the desirability of an invention for a given purpose. He must show, at least in a general way, how the machine for instance, is to be constructed. In some factories it is the custom to patent every invention in the name of the president of the company. The dangers of this procedure are pointed out, and it is shown that if the real facts of the inventorship were brought out, such a patent, where the invention is made by an employe, and not by the president, would be declared invalid.

The Rights of an Employer.

Where an employer employs clever men and has them instructed in the details of his business, he lays himself peculiarly open to the possibility that the employe may make inventions which will seriously hurt his business, if he had to compete with them. It, therefore, becomes exceedingly important to consider what are the employer's rights under these circumstances. The mere fact that an inventor was in the employ of another when he makes an invention does not give the employer any claims upon the invention. If, for instance, the employe make an invention out of working hours, and in his own home and does not use the time, material or employes of his employer in perfecting the invention, the employer, in the absence of a contract, has no claim whatever on the invention, even though it relates to the employers business. If, however, the employe makes an invention in the shop of his employer and perfects it there, using his employer's time and material, and the assistance of his fellow employes in perfecting the invention, the employer has what is called a "shop right" or license to make and use the invention in his own shops, and to sell the article so made. This, however, alone does not give the employer a right to the patent itself, that is, the right to prevent others from making, or using, or selling the patented invention. The employe can license his employer's competitors to make and use and sell the said invention, but he cannot enjoin his employer. If the

employer wants to ensure that he shall have the title to patents or inventions relating to his business that may be made by his employees, he must have a contract with the employees, specifically providing that he shall have such right. A number of instances of such contracts are related, and some of the contracts themselves are quoted in the papers. The courts have held that such contracts are valid even though the employe is not to receive higher wages than he would probably otherwise have received.

FRESH AND SALT WATER FROM THE SAME WELLS.

A member of the United States Geological Survey, engaged in making investigations of ground-water conditions in Ohio, reports that in Hamilton County, about half a mile south of New Burlington, there is a well which yields fresh and salt water at the same time. Except for the fact that two pumps are set in it side by side it resembles ordinary wells; but one of the pumps supplies water excellent to taste, while the water from the other is so highly charged with various mineral salts that it is almost brine. This water has been recommended by some physicians as having high medicinal value. When first dug, several years ago, the well was a great wonder to the people of the surrounding country, who flocked in great numbers to see it and taste its unusual water.

The secret of the phenomenon lies in the fact that two water-bearing beds confined between layers of limestone occur at this point, the upper carrying fresh water and the lower salt. The pipe of the fresh water pump is but 16 feet long; that of the salt-water pump is 35 feet. The brine, being heavier than the fresh water, does not mix with it

but remains at the bottom of the well, and the longer pipe consequently draws only the salty water.

CORRECTION AS TO THE PURCHASE OF MACHINERY.

In our August issue we stated that the Bradley Pulverizing Co. had sold the entire grinding installation for the Ajax Portland Cement Co.'s plant. This was an error. Thomas Prosser & Son, 15 Gold St., New York, N. Y., upon the recommendation of Messrs. Westinghouse, Church, Kew & Co., sold the entire preliminary grinding equipment to the Ajax Portland Cement Co., consisting of Krupp patent ball mills, prior to the purchase of the Griffin mills which will be used only at the finished end of the Ajax Co.'s plant.

The York Portland Cement Co., of Portsmouth, O., was to have started up by October 1st, but on account of the delay in completing buildings, the plant will not be ready for some time. The machinery is practically all installed.

CONVICT LABOR IN CHICAGO.

Warden Whitman of the Bridewell Prison has been utilizing prison labor in street improvements. Some 1400 feet of sewers were built on California Ave. The street was graded and filled in. Cement curb and gutters built, and the street paved with crushed stone from the prison quarries; all work conforming to city specifications prepared by the engineering department.

The Sandusky Portland Cement Company, Dixon, Ill., plant started up on September 17th. W. E. Wueith, Supt.; Harvey Durbin, Assist. Supt.

IMPORTS OF CEMENT INTO THE UNITED STATES.

WHERE FROM	JULY				ELEVEN MONTHS ENDING JULY			
	1906		1907		1906		1907	
	Quantity in lbs.	Value in Dollars	Quantity in lbs.	Value in Dollars	Quantity in lbs.	Value in Dollars	Quantity in lbs.	Value in Dollars
United Kingdom	11,569,000	\$32,873	25,032,420	\$ 88,910	31,697,600	\$ 91,086	132,771,216	\$ 458,002
Belgium	10,857,349	31,339	11,083,541	29,800	64,021,062	197,880	168,714,696	492,919
France	1,488,000	5,095	1,488,000	5,094	6,980,616	24,379	7,093,300	27,393
Germany	15,461,293	54,581	21,623,118	86,963	116,302,973	391,629	187,842,904	606,968
All Other Europe			198,414	558	8,332	22	927,763	2,109
British North Am.	890,370	6,432	32,500	165	2,229,920	15,294	145,000	902
Other Countries	22,381,119	102,453	1,316,979	7,008	41,787,616	184,609	4,238,218	22,509
TOTAL	62,647,731	232,773	60,774,072	218,498	262,728,119	905,419	502,333,097	1,610,802
Domestic Exports of Cement, bbls.	57,292	82,193	87,837	149,155	528,485	506,395	485,186	800,086

There were 6,157,828 lbs. of imported Roman and Portland Cement, etc., in the United States bonded warehouses in July, 1906, valued at \$18,021, against 6,973,246 lbs. in July, 1907, valued at \$18,906.

For seven months ending in July, 1906, there were 52,629 tons of asphaltum imported in the United States, valued at \$216,554 against 62,053 tons imported in seven months ending July 1907, valued at \$469,443.

ADVANCES IN CEMENT TECHNOLOGY, 1906.

By Edwin C. Eckel.

Introduction.

The year 1906 was a prosperous and satisfactory year for the American cement industry, being marked by increases both in production and in profits. The year was notable, moreover, for certain developments of both industrial and technologic importance, which seem calculated to have an important effect on the future of the industry. In a later section of this report the statistics of production and value, arranged by States, are presented in tabular form. In the present section an attempt will be made to use these statistics as a basis for discussion of points which seem of general interest and importance.

Growth of the Portland Cement Industry.

Before taking up matters which relate specifically to the Portland-cement industry, it will be of interest to compare its growth with that of a nearly related industry—the manufacture of pig iron. This is done graphically in fig. 1, reproduced in revised form from the Engineering Magazine, which shows what may be called the "growth curves" of the two industries for the period 1890-1906, inclusive. The figures on which this diagram is based are official, except for the present year, where estimated quantities are given.

The diagram is, of course, distorted to the extent that, while the pig-iron production is given in long tons (of 2,240 pounds), the cement output is stated in barrels (of 380 pounds). But this distortion does not affect the value of the diagram when used for its present purpose—a comparison of the form of the two growth curves.

On examination it will be seen that the cement curve rises steadily at an increasing ratio each year, showing no downward flexures or relapses. This is the normal form for the growth curve of a young and rapidly expanding industry. The iron curve, on the other hand, though showing a decided gain for the period covered, also shows at intervals depression flexures, typical of a mature industry, whose annual output must now depend on the general financial and industrial condition of the country.

The cement output, as yet, has not suffered markedly from financial depressions. Prices have fallen off in poor years, it is true, but the annual output has always increased. The rise in yearly output from 1885 to 1906 has not only

been continuous, but has even shown a tendency to increase its rate of increase. Of course, such a condition of the industry can not be expected to see the rate of increase lowered, and finally, in some period of business depression, some year will show a lower output than the preceding year. This will mark the end of the youth of the cement industry and the beginning of its period of maturity. Though the present condition of the industry is as prosperous as might be desired, it is entirely possible that the change in the rate of growth may be near at hand. The new construction of 1906 and plants to be built in 1907 will provide a great increase in mill capacity. If the succeeding years are generally good this increase will be taken up without difficulty, but a general financial depression in 1908 would probably result in a temporary and, perhaps, a severe check to the cement industry. So far as can be estimated now, the plants which will be in operation before the end of 1907 will turn out cement at the rate of over 55,000,000 barrels per annum, and it is doubtful whether such an output could be absorbed if the business affairs of the United States were not in a generally prosperous condition.

Raw Materials in Use.

For a number of years past the writer has published annually, at first in the columns of Engineering News and later in Mineral Resources of the United States, tables showing the quantities and the percentages of the total Portland cement output produced from different raw materials. The table following is a continuation of this series, though it has been rearranged so as to be more suited to the apparent trend of trade conditions. The production from chalk and clay has been combined with that from ordinary limestone and clay, as the former showed no tendency to increase. On the other hand, the Portland cement produced from slag and limestone is this year given separately. Practically all of this last class is and has been produced by the United States Steel Corporation, and the fact that it is possible to present these figures without violation of confidence is due entirely to the peculiarly frank and open manner in which the affairs of that corporation are conducted. The figures given are quoted from recently published official statements, and can be accepted as approximating closely to the total production of Portland cement from slag and limestone.

The production is grouped as follows:

Type 1 includes cement produced from a mixture of argillaceous limestone ("cement rock") and pure limestone. This is the combination of materials used in all the cement plants of the Lehigh district of Pennsylvania and New Jersey, and also at several western plants.

Type 2 includes cement made from a mixture of comparatively pure limestone with clay or shale. This mixture is employed at many plants all over the United States.

Type 3 includes cement manufactured from a mixture of marl and clay. This type of mixture is used only in the states of Michigan, Ohio, Indiana, and New York.

Type 4 includes Portland cement manufactured from a mixture of limestone and blast-furnace slag.

The figures for 1906, given in this table, show a continuation of movements which have been in existence for some time. The production from "cement rock" is very slowly falling off in relative importance, that from marl is falling off rather rapidly in percentage, while the production from limestone-clay and limestone-slag mixtures is rapidly increasing. From what is known of the present conditions of the marl and slag plants, and of

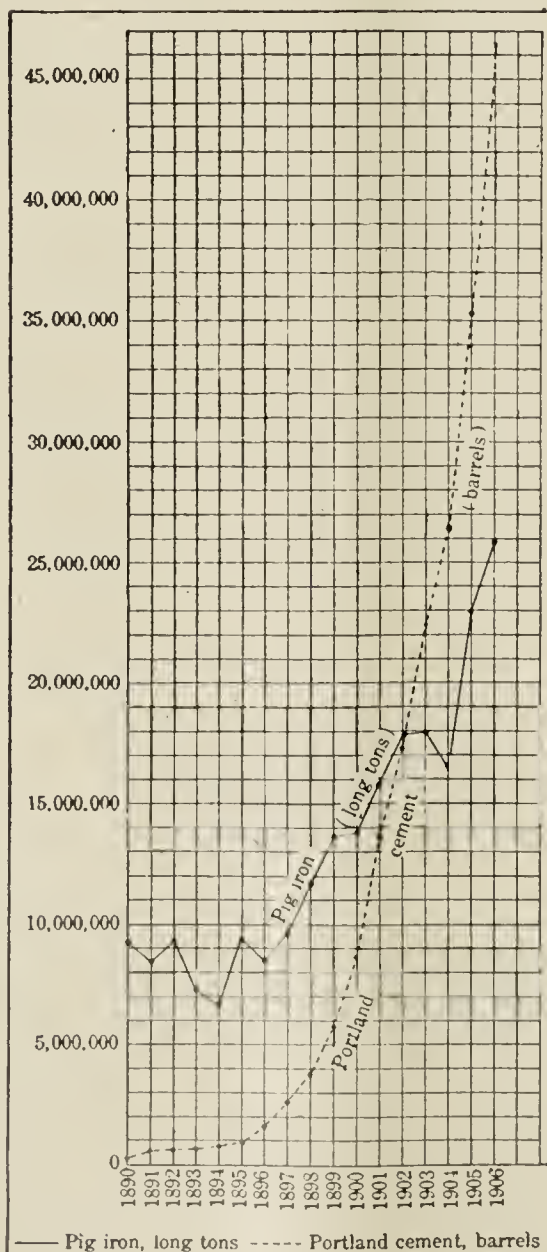


FIG. 1.—Comparison of Portland cement and pig-iron production, 1890-1906.

plans for future changes and new construction, it is probably safe to say that within four years more Portland cement will be made from slag than from marl. It must be recognized that marl plants operate under serious natural disadvantages, not only a marked increase annual-

ly in the number of kilns in existence, but a very decided increase in the length of these kilns. Data on this point are presented in the next section, reference being made to it here merely to explain the increase put. This has, at any rate, been attempted, and the results are presented in the following table. In explanation of this table it may be said that the average annual output of a 60-foot kiln, fired with powdered coal and working on a dry mixture of limestone and clay, is taken at 100 per cent. The average outputs of similar and longer kilns working on various raw materials is then referred to this standard, the results being expressed in percentage.

Production, in barrels, and percentage of total output of Portland cement in the United States according to type of material used, 1898-1906.

Year.	Type 1. Argillaceous lime- stone (cement rock) and pure limestone.		Type 2. Limestone and clay or shale.		Type 3. Marl and clay.		Type 4. Slag and limestone.	
	Quantity.	Per- centage.	Quantity.	Per- centage.	Quantity.	Per- centage.	Quantity.	Per- centage.
1898	2,764,694	74.9	365,408	9.9	562,092	15.2		
1899	4,010,132	70.9	546,200	9.7	1,095,934	19.4		
1900	5,960,739	70.3	1,034,041	12.2	1,454,797	17.1	32,443	0.4
1901	8,503,500	66.9	2,042,209	16.1	2,001,200	15.7	164,316	1.3
1902	10,953,178	63.6	3,738,303	21.7	2,220,453	12.9	318,710	1.8
1903	12,493,694	55.9	6,333,403	28.3	3,052,946	13.7	462,930	2.1
1904	15,173,391	57.2	7,526,323	28.4	3,332,873	12.6	473,294	1.8
1905	18,454,902	52.4	11,172,389	31.7	3,884,178	11.0	1,735,343	4.9
1906	23,896,951	51.4	16,532,212	35.6	3,958,201	8.5	2,076,000	4.5

that these disadvantages are masked by general high prices during such prosperous seasons as we have recently experienced, but that they become painfully apparent during years of general depression. When cement sells at 85 cents or less per barrel at mills in the Middle West, as it may very well do in 1908 or 1909, it will be an even more serious matter to have water in the raw mixture than to have it in the rock.

in average output per kiln. In 1902 each active rotary kiln averaged 36,909 barrels during the year; in 1905 this average was increased to 48,118 barrels; in 1906 the average output per active rotary rose to 58,901 barrels. It is probable that the annual average per kiln for 1907 will exceed 60,000 barrels, and with the increased number of kilns then in operation the Portland-cement output of 1907 may reach 15,000,000 barrels.

Length of kilns in use and under construction.—The data obtained as to the length of kiln in both operating and new plants are summarized in the following table. As will be seen by comparison of the totals in this table with those of the preceding table, the statistics as to length are almost complete:

Kilns and Kiln Practice.
The statistical inquiry card for 1906 contained a number of questions relating to technologic matters which have heretofore been neglected. The questions relative to number and length of kilns were answered by practically all the cement producers of the country, and the results so obtained are summarized below.

Total number of kilns.—Tables showing the number and types of kilns in use at various dates have been published in preceding volumes of Mineral Resources. Omitting vertical or stationary kilns, these figures, with the data collected this year, may be summarized as follows:

	1902	1905	1906
Operated	456	722	793
Idle	9	23	2
Building	46	42	104
Total number rotary kilns	511	787	899

In this table the kilns listed as "operated" were those actually in operation during part or all of 1906; the "idle" kilns were those at mills which were not in operation at any time during the year, but which are still in good condition; the "building" kilns include only those which are in plants actually under construction and sufficiently far advanced to be able to enter the 1907 production.

Average output per year.—As noted in last year's report, there is

Raw material	Length of kiln			
	60ft.	80ft.	90ft.	100ft.
Cement rock and lime-				
stone	126	164	182	216
Limestone and clay	100	150	166	190
Marl and clay	54	76		

These averages plot into a fairly smooth curve, and seem worthy of attention. Unfortunately the results obtained from kilns fired with oil, natural gas, and producer gas were too few and too uneven to be considered in this connection, so that the table refers only to coal-fired kilns. The results in running on a slag-limestone mixture are omitted for obvious reasons, but they fully justify everything that has been said regarding the remarkable kiln efficiency which can be attained in a plant using this mixture.

Localization of the Industry.
The Portland-cement industry exhibits the same tendency toward geographic centralization, though to a less degree, that has given Pittsburgh its preeminence as an iron producer. In the case of the Portland-cement industry the concentration of plants is in the so-called Lehigh district of Pennsylvania, with its New Jersey continuation. Here, 18

Length of kilns.

Length of kiln.	Number of kilns operated in 1906.	Number of kilns under construction.	Length of kiln.	Number of kilns operated in 1906.	Number of kilns under construction.
60 feet and less	398		105 to 110 feet	80	24
70 to 78 feet	40		120 feet	17	16
80 feet	69		125 feet and longer	57	33
85 to 90 feet	66				
95 to 100 feet	52	22	Total	779	92

This table brings out very sharply the rapidity with which kilns are lengthening, and also the diversity of opinion which still exists as to the relative merits of the various lengths above 100 feet.

Variation in output with length of kiln, etc.—The statistical data received from each plant this year included information as to total output, number and length of kilns, and duration of total shut downs. By means of these data, which cover a very wide range of material, practice, and operating conditions, it seems probable that average results of fair accuracy can be deduced as to the effect of raw material, and length of kiln on the out-

plants made almost 23,000,000 barrels, or almost exactly half of all the cement produced in the United States in 1906. The Lehigh district was the point where American Portland-cement manufacture was first undertaken, and it owes its continued preeminence to the possession of good raw materials, good labor, good and fairly cheap fuel, and excellent transportation facilities to large eastern markets.

Taking a general view of the matter, the present geographic distribution of the cement industry is well shown in the following table. The term "East" as here used, includes plants in Pennsylvania, New York, and New Jersey, none being located

in New England. The "Central" plants are those in Ohio, Indiana, Illinois, Michigan, and Missouri. Under "West" are included Kansas, Colorado, South Dakota, Arizona, and Utah. On the Pacific coast are the three active California plants and one recently started in Washington. The "South" includes Virginia, West Virginia, Georgia, Alabama, Arkansas, Texas, and Kentucky.

of manufacture. No "trust," nor even any approach to a monopoly, is now in existence, newspaper statements to the contrary notwithstanding; and in the writer's opinion the nature of the cement industry renders it imperative that any such large degree of consolidation of interest can take place as to result in permanently or unfairly high prices for the product.

When the history of both success-

which cement could be made if prices were forced high enough. The Standard Oil Company, the United States Steel Corporation, and the United States government could not, by combining their financial resources, hope to acquire control of any large fraction of this immense reserve of raw material.

Since the supply of limestone and clay can not be cornered, since no essential parts of the processes of manufacture are covered by exclusive patents, and since transportation companies will seek freight, it is reasonable to believe that no cement combination can succeed in permanently raising prices to unfair rates. As already stated, there is nothing in existence at present even remotely approaching a cement trust. The trouble is rather in the other direction. The prosperity of the last few years, with reports of enormous profits earned by existing companies, has led to the building of many new cement plants. A fair proportion of these are either too small, badly located, faulty in design, or badly managed; and with the first general business depression and the commencement of falling prices such plants will necessarily become a danger to the entire industry. The condition at present is therefore marked by excess rather than lack of competition.

At present, indeed, the only limitation on unprofitable increase in the number of cement plants arises from the fact that even the smallest units are expensive to construct and operate. In any district where competition could be expected, for example, it would usually be inadvisable to build a smaller than a 4-kiln plant. This plant would have an output of 1,500 barrels or more per day; but its construction would cost \$350,000 to \$450,000, and it would require a working capital of \$125,000 to \$175,000 in addition. Evidently, therefore, the cement industry is not one in which individuals or small firms can find much of an opening.

Normal Growth and Concentration.

Although, as already stated, it is impossible that the cement industry should ever become a monopoly based on control of deposits of raw materials, another phase of the subject requires consideration. The cement industry is essentially one in which brains and money are far more important than raw materials, with intelligently directed capital will rapidly increase in size, while poorer or ill-managed plants either remain stationary or expand very slowly. This of itself operates to cause a gradual concentration of in-

Geographic distribution of Portland-cement industry in 1905 and 1906.

	Number of plants operating.		Output, in barrels.		Percentage of total output.	
	1905.	1906.	1905.	1906.	1905.	1906.
East	30	31	19,589,675	25,483,025	55.6	54.9
Central	32	34	10,723,802	14,030,665	30.4	30.2
West	7	8	2,470,349	3,834,656	7.0	8.2
Pacific coast	3	4	1,225,429	1,310,435	3.5	2.8
South	7	7	1,237,557	1,804,643	3.5	3.9
Total	79	84	35,246,812	46,463,424	100.0	100.0

The year shows a slight relative increase in the Western and Southern States as compared with conditions in 1905. Western areas will be supplied much better than they are at present. A powerful impetus in this direction was given by the destruction of San Francisco, which called to the attention of investors in the Eastern States and in England the fact that the Pacific Coast States could normally absorb much more cement than was made on the coast. In the face of the San Francisco disaster the few western plants in operation were not capable of making much impression on the immense and instant demand.

In the South, too, there is an excess of demand over supply, and the few plants now actually under construction in the Southern States will hardly reduce this excess. It is probable that the States south of the Potomac and the Ohio and east of the Mississippi could use, at profitable prices, about five times as much cement as is now made in that district; and for a long time this field will be one of the most profitable ones for the cement manufacturer. Fuel is cheap, raw materials are abundant and good, and the demand is steadily increasing.

The Difficulty of Monopoly.

Perhaps the most marked feature of American economic history during the last decade has been the manner in which industry after industry has become consolidated in control, so as to approach more or less closely to monopoly. This has been particularly well marked in the iron and steel industries, and it is worth considering how far a similar evolution is likely to affect the cement industry. At present the cement industry is the most individualistic of the larger branches

ful and unsuccessful "trusts" is examined it will be seen that the only way in which a permanent monopoly can be secured and retained by any consolidation is by the control of the supply of raw material, by the absolute control of basic patents, or by the control of transportation. Any trust which disregards this history, and is content with simply consolidating all or most of the existing manufacturing plants, is in line for disaster; for, supplies of raw materials being still available for outsiders, the first advance in prices will be the signal for the erection of competitive plants. If, on the other hand, the raw materials can be cornered, or processes can be monopolized, or transportation can be controlled, there is no possibility of competition. This experience, though unobserved or disregarded a decade ago, is now generally borne in mind.

The bearing of these facts upon the future of the cement industry is obvious enough. If there is any possibility that one large cement corporation can acquire control of most of the available deposits of cement material in the United States, it will be possible to form a real American "cement trust," to defy competition, and to raise prices to an unwarranted level. If, on the other hand, it is impossible to form such a corner in cement rock or in cement-making processes, or permanently to control transportation, it will be impossible for any consolidation to raise prices permanently above the normal.

On careful consideration of the matter it will be seen that only one answer is possible. It is safe to say that more than 20 per cent of the entire area of the United States is underlain by raw materials out of

terest; the stronger plants grow at the expense of the weaker.

Most of the larger companies which now produce the bulk of the American cement output were originally concerns of only average size. Their growth has taken place in a natural manner, not by the absorption of competitive plants, but by using part of the profits of the business to increase the size of the original plant. In a strongly held and well-managed company this course of action is possible. In a company less strongly owned or less intelligently directed the tendency is always to sacrifice the prospects of ultimate success to the certainty of immediate returns. A company owned by a number of small stockholders can rarely withstand the pressure to pay out all the profits of an unusually prosperous year as dividends.

The larger company, growing by accretion, has also a certain advantage in the matter of advertising its products. When a new plant is established by an old company there is no difficulty in introducing the cement from the new plant, for it sells under an already well-known brand name, and has behind it the accumulated prestige of all the older plants.

During the year 1906 progress toward concentration of interests has been marked. The formation of the North American Cement Company in the East and the Iola consolidation in the West have attracted general attention to this phase of the cement industry.

Capitalization and Promotion.

From two evils more serious than monopoly—over-capitalization and fraudulent promoting—the American cement industry has been fairly free, though there are signs that this happy immunity is not destined to continue. So far as the first is concerned, figures obtained unofficially from various sources indicate that the total authorized capitalization of all the American Portland-cement plants operating in 1906 falls within the limits of \$110,000,000 and \$125,000,000. This estimate takes no account of outstanding bond issues, but, on the other hand, gives no credit for stock authorized but not issued. On the whole, therefore, it can be accepted as representing very fairly the total capitalization of the entire industry, and can not be considered excessive.

Considering the matter broadly, it can be said that in the East, including the plants from New York to Illinois, there has been little attempt at over-capitalization or fraud. Most of these older com-

panies were organized by persons familiar with the business, and the necessary capital was secured more or less privately, with little attempt to raise money by selling stock to the public. Michigan, apparently, was the first State in which the promoter found an opportunity to display his peculiar talents, and for a number of years that State was dotted with prospective cement plants. Most of these flotations were capitalized excessively, owing to the fact that for the first time in the history of the industry the stock was being sold to the public by promoters. Advertisements of stock for sale at 10 cents or \$1 per share, with promises of 20 to 60 per cent dividends and with wonderful miscalculations as to operating costs, filled the papers of the Middle West during this period.

After the Michigan boom had collapsed, leaving behind it a few good plants, a few poor ones, and a much larger number which had never come into existence other than in the prospectus, the promoter was for a few years scarcely seen or heard of. His reappearance took place when the Iola plant proved the profits in making cement in the natural-gas belt in Kansas, and for the last few years there have been exaggerated statements of the profits awaiting the erection of cement plants in the States west of the Mississippi, notably in Kansas and Iowa.

STATISTICS OF CEMENT INDUSTRY IN 1906.

By L. L. Kimball.

Introduction.

General Conditions.

The cement industry, as a whole, in 1906 was in a very prosperous state. Prices continued good throughout all parts of the United States, and in several localities they increased materially over those prevailing in 1905. The market was steady, and though the supply was greater than that of any preceding year, the demand kept pace with it, and in most localities, exceeded it. The year closed with a gratifying indication of prosperity in the immediate future.

The greatest and most prosperous branch of the industry is, of course, the Portland-cement branch. The phenomenal growth of the Portland product has been noted before in these reports; but it may be made more impressive to the general public by stating that twenty years ago, in 1887, when the Portland output

of the entire country stood at about 250,000 barrels, as against a production of somewhat more than 6,900,000 barrels of natural cement, the first attempt was made in the United States to use the Ransome process of burning cement—that is to say, to introduce the rotary kiln for the manufacture of Portland, instead of the vertical, or dome-shaped, kiln used at that time. The attempt was made near Portland, Oreg., and although that effort was not successful, it resulted in the improvement and adoption of the rotary kiln in this country. One difference between the process as it was then and as it is now used is this: In 1887 the company exploiting the new process proudly claimed an ability to produce 30,000 barrels of cement per annum, which would be tripled as soon as the necessary machinery for grinding should be added. To-day a company does nothing extraordinary in announcing that its plant will produce 3,000, 4,000, or 5,000 barrels of Portland cement a day, while the per annum production of the large plants run well into millions of barrels. It was ten years later, 1897, before the production of Portland cement had increased to 2,500,000 barrels; but in the next decade it went forward with tremendous strides.

The quantity of cement exported by the United States to foreign countries is not yet as large as it should be. This condition may be due to the great demand for it in the United States. But with the continued increase in the number of plants, and the consequent increase in production, foreign trade can not long be neglected. There are a dozen States in which new plants are actually being built to be ready for operation late in 1907 or early in 1908, and more than that number in which plants are projected. When the plants that are in process of erection (not including those which as yet are but planned) begin to produce, the output for the entire country will be again greatly increased. In view of these conditions, it would certainly seem wise to make at least an effort to build up a profitable trade with foreign countries.

The decline of the natural cement industry has been gradual, but as steady as the increase of the Portland branch. In 1906 the effect of this decline seemed to be even more widespread than in the preceding year, extending far into States which have not before felt its influence as strongly as have the eastern centers of natural cement production. No new States appeared

as producers of this variety of cement, nor were any new plants built for producing it. The owners have for the most part allowed their kilns to remain idle, apparently waiting for a turn in the tide. Some have turned their attention to the burning of lime and kindred employments, and a few have dismantled the old plants and put in buildings and machinery for making Portland cement. Since the limestone which is known as "cement rock," from which natural cement is made, sometimes forms an equally good base for Portland cement, the latter course seems to be the logical and wise one where the financial part of such transition can be arranged. The business affairs of the Louisville district are in the same condition as they were last year.

The growth of the slag, or puzzolan, branch of the cement industry is interesting because of its steadiness. For about twenty years it has been doing a little, but for the last three years one new plant in a new State has been built annually to produce puzzolan cement. New works are being erected in Pennsylvania at the present time, and those which were built in Kentucky and in New York are both profitable producers. Of course the process of making this kind of cement is not nearly so expensive nor so extensive as the process required for burning and grinding Portland cement.

The rotary kilns necessary for producing Portland cement have been increased in size and otherwise improved to an extent which precludes a low price for them. Whereas in earlier years a 60-foot rotary was considered excessively large, to-day the extreme length is 150 feet. The increase in diameter has been only small. In the manufacture of puzzolan cement rotary kilns are not used.

Acknowledgements.

In making acknowledgements for the courtesies so universally extended in 1905, the writer had occasion to call attention to the fact that the statistics of production in this report are based entirely upon the actual returns sent from the different cement plants in the United States and that those used in the preliminary statement issued in advance of the full report are also based on such returns; that, such being the case, it is impossible to issue the statement until practically all the returns are in; and that therefore the date of the issue depends largely on the manufacturers themselves.

Since the statement is requested

at an early date by people who are not producers, each year, and since letters are always received by this Bureau from cement makers asking for the statement as soon as possible, this matter is again touched upon. It seems as easy to send the information in response to a first request as to a third or fourth request. In other words, if the statement is to be sent in at all, it should not be delayed a day, because any delay prevents every other producer from receiving the earliest possible statement of the annual production.

The writer is indebted to cement producers in most of the States from New Jersey to California for many courtesies during personal visits to their plants, and these remarks are made solely with a desire to be able to comply with the wish of the producers and to issue the figures at an early date.

Production, in barrels, of Portland cement in the United States in 1904-1906, by States.

State.	1904.			1905.			1906.		
	Number of works.	Quantity.	Value.	Number of works.	Quantity.	Value.	Number of active works.	Quantity.	Value.
Alabama	1			1			1		
Arizona	1			1			1		
California	3	1,014,558	\$1,446,909	3	1,225,429	\$1,671,816	3	1,310,435	\$2,110,294
Colorado	1	490,294	638,167	1	786,232	1,172,027	1	1,146,396	2,034,382
Georgia	1			1			1		
Illinois	5	1,326,794	1,449,114	5	1,545,500	1,741,150	4	1,858,403	2,461,494
Indiana	4	1,350,714	1,232,071	6	3,127,042	3,134,219	6	3,951,836	4,964,855
Kansas	2	2,643,939	2,134,612	4			4	3,020,862	3,908,708
Kentucky	1			1			1		
Michigan	16	2,247,160	2,365,656	16	2,773,283	2,921,507	14	3,747,525	4,814,965
Missouri	2			2	3,879,542	4,164,974	2	3,350,000	3,260,000
New Jersey	3	2,799,419	2,099,564	3	3,654,777	2,775,768	3	4,423,648	4,445,364
New York	11	1,362,514	1,257,561	11	2,111,411	2,044,253	9	2,414,362	2,725,744
Ohio	7	910,297	987,899	8	1,312,977	1,390,481	8	1,422,901	1,709,918
Pennsylvania	17	11,496,099	8,969,206	18	13,813,487	11,195,940	19	18,645,015	18,598,439
South Dakota	1			1			1		
Texas	2			3			2		
Utah	1			1			1		
Virginia	1	864,093	774,360	1	1,017,132	1,033,732	1	1,172,041	1,432,023
Washington	1			1			1		
West Virginia	1			1			1		
Total	81	26,505,881	23,355,119	89	35,246,812	33,245,867	84	46,463,424	52,466,186

The returns for 1906 are particularly full and complete. In no case were the figures refused, and in most instances every question was answered. Such cooperation is productive of the best results, and for it much appreciation and hearty thanks are hereby tendered.

Production.

The statement made last year that 1905 was the record year thus far in gain in total production of hydraulic cements in the United States over a preceding year applies equally this year to 1906.

The increase for 1905 over 1904 was above 8,000,000 barrels in quantity and \$9,000,000 in value; but the gain of 1906 as compared with 1905 is 10,898,137 barrels of cement in quantity and \$19,370,744 in value.

The total production of cement in 1906 was 51,000,445 barrels, valued at \$55,302,277; the total production in 1905 was 40,102,308 barrels, valued at \$35,931,533.

The production of Portland ce-

ment in 1906 was 46,463,424 barrels, valued at \$52,466,186.

The production of natural cement in 1906 was 4,055,797 barrels, valued at \$2,423,170.

The production of puzzolan cement in 1906 was 481,224 barrels, valued at \$412,921.

These amounts are somewhat greater than those given in the preliminary statement of cement production issued by this Bureau earlier in the year. The difference is due to the fact that some of the returns from plants were received too late for use in the first statement. Such preliminary statements, however, are always issued with the understanding that while the amounts reported will not be decreased they may be somewhat increased.

The prices at which cement was sold in 1906 were higher than those

which prevailed in 1905. They were not inflated, however, but were on a healthy normal basis. The producers made no complaint of prices, but from nearly every State in the Union protests were made as to the grave difficulty of obtaining sufficient car service for the delivery of orders.

PORTLAND CEMENT.

Production.

The following table is designed to show the quantity and value of the Portland cement made in those States which were producers in 1904, 1905, and 1906:

As heretofore, the production of those plants which are the only ones in their States are so combined that the figures may not be published in a form which will reveal individual production.

The cards of request for figures and information annually issued by this office state that all facts and data sent in are regarded as confidential unless there is a special un-

derstanding to the contrary. Individual figures showing quantity or value of production are very seldom published, and if in rare instances such a publication is considered desirable it is never made without express permission from the producer.

In the foregoing table the outputs of Alabama, Georgia, West Virginia and Virginia are combined; the production of Kentucky is given with that of Missouri; Colorado, Utah, Texas, South Dakota, and Arizona are combined; and in each instance the total sum of the combined figures is placed against the name of the State that contributed the largest quantity of cement to that total.

In 1906 there was great activity in the Portland-cement industry. States which have heretofore not produced cement began the erection of Portland-cement plants; mills that were making their initial runs did well; and some of the centers of activity increased their productive capacity, either by constructing new plants or by remodeling old ones.

Indian Territory, Iowa, and Arizona appear in 1906 for the first time in the list of cement-producing States.

In Kansas four new companies erected plants near the Iola center, which offers great inducements to capitalists by reason of its vast limestone deposit and its natural-gas belt. In addition to this fact the State is centrally located and can find a profitable market in any direction. In Pennsylvania, that great center of Portland-cement making, where the largest plants in the world are operating, five additional plants are now being built; Kentucky and Tennessee, in the South; Utah, Michigan, and Wisconsin, in the North and West; and Montana and Washington, in the extreme Northwest, are all either actively building or are planning to build new Portland-cement plants; while Missouri, which already has a large production, is now adding three plants to her present capacity. California has changed from being a large importer to being a large producer, and is increasing the capacity of present plants as well as constructing new ones.

The rank of the Portland-cement producing States remains as it was in 1905 so far as place goes, though the record as to the proportion of the production that gave each State its place has changed considerably. Pennsylvania, of course, is at the head of the list; but while in 1905 her lead was a little above 10,000,000 barrels this year her surplus above New Jersey, her closest com-

petitor, is well over 14,000,000 barrels, and in spite of the great increase in the output of the entire country Pennsylvania manufactures 40.1 per cent of the total product. This percentage is a little larger than it was in 1905 and in that year it was less than in 1904, but that falling off merely indicated a great increase in the total production, and not a decrease in Pennsylvania's output.

In 1906 New Jersey, although she has but three producing plants, still holds her place as second largest producer of Portland cement. Her lead over the other States standing next is not very large, however, and the increase in the capacity of the plants of the Western States may result in displacing her within a short time. Her production this year amounted to 9.5 per cent of the total output.

Indiana approaches New Jersey a little more closely in 1906 than in 1905, and leads Michigan by a diminished quantity. For the last few years the difference between the production of these two States has not been large. Indiana's output in 1906 was much greater than that for the preceding year, and her production was 8.5 per cent of the whole. These three States, which head the list, made more than 58 per cent of all the Portland cement produced in the country in 1906.

Michigan still holds fourth place, as in the previous year.

The table which follows shows the growth of the cement industry in the United States. Its form was originally determined by the fact that the cement production was confined mainly to certain well-defined centers, but changes in conditions since 1900 have necessitated a change in form.

Under "all other sections" is in-

cluded the production of Alabama, Arizona, California, Colorado, Georgia, Illinois, Indiana, Kansas, Kentucky, Missouri, South Dakota, Texas, Utah, Virginia, West Virginia, and of other counties in Pennsylvania than Lehigh and Northampton counties.

(Continued in October issue.)

The Sandusky Portland Cement Co., manufacturers of the Medusa Waterproofing report furnishing their waterproofing material for the following work:—Grand Rapids, Mich., Refrigerator Co. plant. The material is also being used in the reinforced concrete dam being built by the D. L. & W. Ry. coal department at Scranton, Pa., and was used in the A. Booth & Co. cold storage plant at Detroit, Mich. The Santa Fe road is using large quantities at Albuquerque, N. M., and Summerville, Tex. Albert Kahn, architect and president of the Trussed Concrete Steel Co., Detroit, Mich., the inventor of the Kahn system of reinforced concrete, used the material throughout the construction of his private residence, just completed.

Mr. Joseph Downey, commissioner of public works of Chicago, states that there has been a decline of 35 per cent in the building industry in the city of Chicago during the months of June, July and August of the present year as compared with the same period in 1906.

W. A. Tyrrell of St. Louis, Mo., consulting engineer for the Continental Portland Cement Co., is preparing details for the company's plant, which is to be erected in St. Louis Co., Mo. The office of the company is in St. Louis, Mo.

Development of the Portland-cement industry in the United States since 1890.

Section.	1890.			1900.		
	Number of works.	Quantity (barrels).	Percentage.	Number of works.	Quantity (barrels).	Percentage.
New York.....	4	65,000	19.4	8	465,832	5.5
Lehigh and Northampton counties, Pa., and Warren County, N. J.....	5	201,000	59.9	15	6,153,629	72.6
Ohio.....	2	22,000	6.5	6	534,215	6.3
Michigan.....	3	3,654,777	10.4	6	664,750	7.8
All other sections.....	5	47,500	14.2	15	663,594	7.8
Total.....	16	335,500	100.0	50	8,482,020	100.0

Section.	1905.			1906.		
	Number of works.	Quantity (barrels).	Percentage.	Number of works.	Quantity (barrels).	Percentage.
New York.....	11	2,111,411	6.0	9	2,414,362	5.2
Lehigh and Northampton counties, Pa.....	15	13,713,910	38.9	17	18,360,965	39.5
New Jersey.....	3	3,654,777	10.4	3	4,423,648	9.5
Ohio.....	8	1,312,977	3.7	8	1,422,901	3.1
Michigan.....	16	2,773,283	7.9	14	3,747,525	8.1
All other sections.....	36	11,680,454	33.1	33	16,094,023	31.6
Total.....	89	35,246,812	100.0	84	46,463,424	100.0

CEMENT SHAPERS OF CUBA.

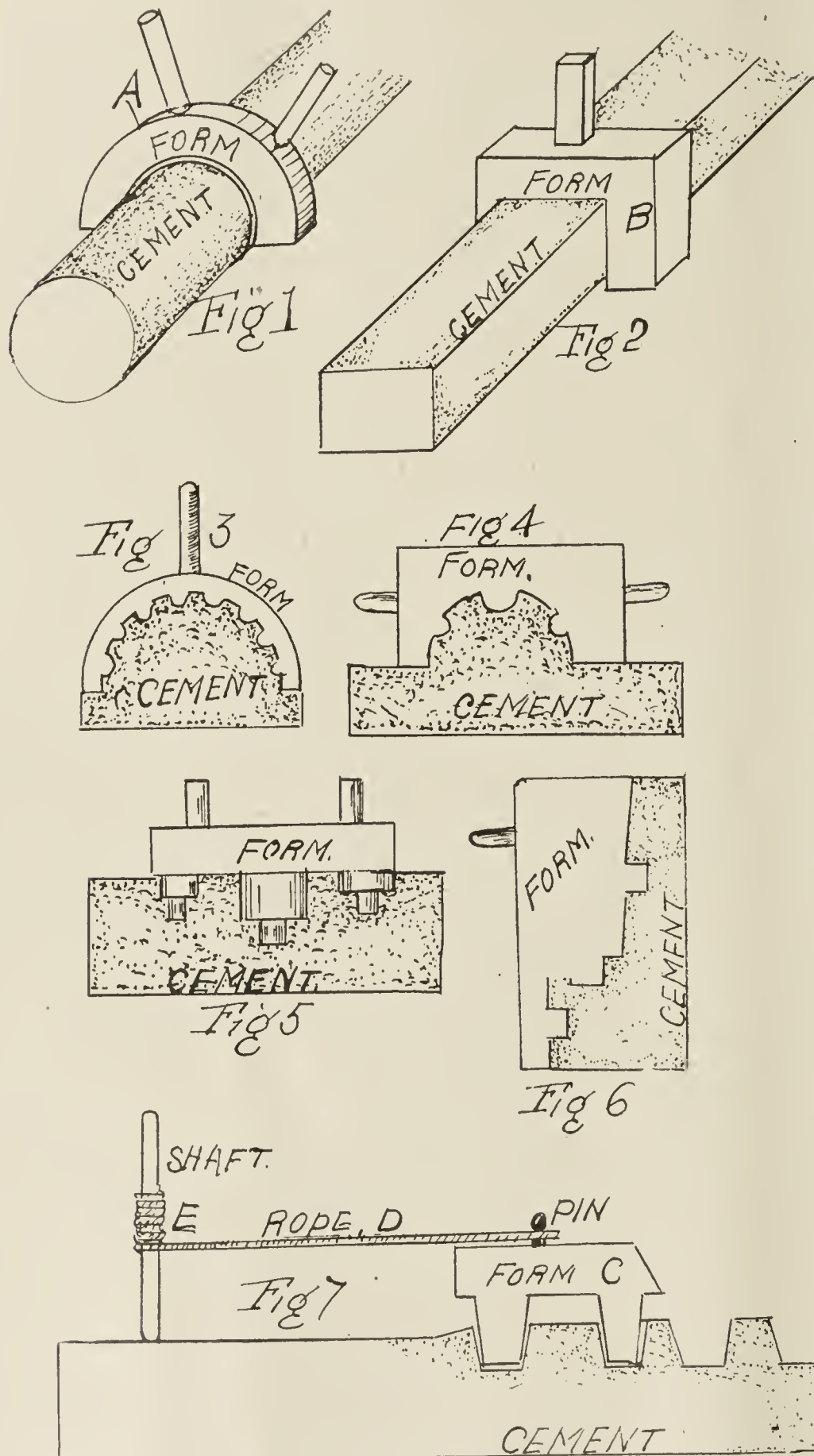
While a large variety of shaping devices are employed for forming various patterns in cement in all countries, the Cuban cement manufacturers outdo them all. The writer is at present traveling in Cuba. He has examined the different modes which are used for making

importing great quantities of the material. You can see it piled up along the docks at Havana. There are thousands of barrels of it in storage in the warehouses of this country. It sells very freely, although the prices rule high as compared with prices in the home markets. The cement users of Cuba

structure. It is particularly of the cornices, the strips of cement mouldings, the posts, pillars, cubes and variously shaped portions that we write in this article.

Much of the artistic shaping of the trimmings of edges of roofs and windows in the cement Cuban house is the result of shaping the same on the ground. You can see the artisan at work with his various moulds, producing the form desired by shoving the shaping contrivance back and forth on the work until the work is rendered perfectly smooth and perfect. Often considerable time is required to get the form right. I have seen several trials made without effect on certain work. Supposing that the workman desires to get a cement post put in. Instead of casting the post as one might expect by means of a casting mould, he often shaped the rounded form from a form of other design, by means of the push-block (A). He takes the cement when it is soft and works it into a condition which will just stand mixing and forming. It has to be much like putty in consistency. The stuff holds to any condition to which it is moulded. The round shape is acquired after moving the form tediously to and fro for some little time. Of if the post should be square, the form b, shown in figure 2, would be used.

Sometimes it is necessary that the workman produce a corrugated effect, in which case the grooved device shown in figure 3 would be employed. In some cases these forms are made from cast iron or other metal. In others they are shaped from hard wood. I saw more wooden shapers than metal ones. Often the project involved consisted in making a line of depressions or ridges along the front side of the building from cornice to cornice. The workman ascends to the roof, and with the aid of his shaping device manages to reach over and down to the working line and produce the pattern in the pliable cement. He has to stretch out full length and make quite a reach to accomplish this. Or he may ascend a ladder and work out a section of the pattern at the time. A form with a handle on either side, so that both hands could be used, would be employed for this work, as shown in figure 4. Then I noticed some shaping forms in the possession of the cement moulding manufacturers in which the forms could be altered by adding on a piece or by removing the same. One of these adjustable forms is shown in figure 5. It will be noticed that



the artistic effects in the building materials. Cement is one of the great factors in building in Cuba. And this cement is shaped into numerous styles of architecture. It is true that much of the stuff is not lasting. It is also true there are weather beaten cement edifices which do credit to the industry. I never saw cement used so liberally before. The Cuban merchants are

have some novel ideas in the working of the material into forms. The process of concrete block-making has been in vogue with them for many years, even though the art may have never been perfected in every detail. Cement buildings prevail to a great extent throughout the island of Cuba, and I notice that nearly all of the buildings now in process of erection are of cement

the projecting pins are secured with stubbs. These stubbs may be opened and the projections taken off and projections of other design substituted, according to the character of the pattern which is wanted. Then there are the sliding flat forms of the patterns shown in fig-

pin is projected into the mass of partly hardened cement and gets a grip there for a centering point. Then the forming device (C) is brought into action by attaching to it the end of a cord on the pin. This cord reaches back to the center shaft (E). Hence by turning the

principle is applied to the fixed lever (F) as in figure 8. There is a base or foundation table on which the cement composition is placed as shown. Then the form is adjusted in proper place and is forced around and around until the pattern of it is moulded in the bed of cement. I observed in one case that a wagon hub and spoke was used for this service as in figure 9.

Other forms are shown in figures 10 and 11. In fact there is an endless variety of forms which are in use. Many of them are used a few times and thrown aside to give place to others of different caliber. In one shop they had several hundred forms in a pile. I was told that all had been used at some time. In some cases the double end shaper of the nature shown in figure 12 is used. This is employed for finer work. The cement block is worked down in its rough condition with the common single devices. Then the two-end contrivance is used. This consists of the shaft with the two end half disks which disks are properly moulded to make the design which is wanted.

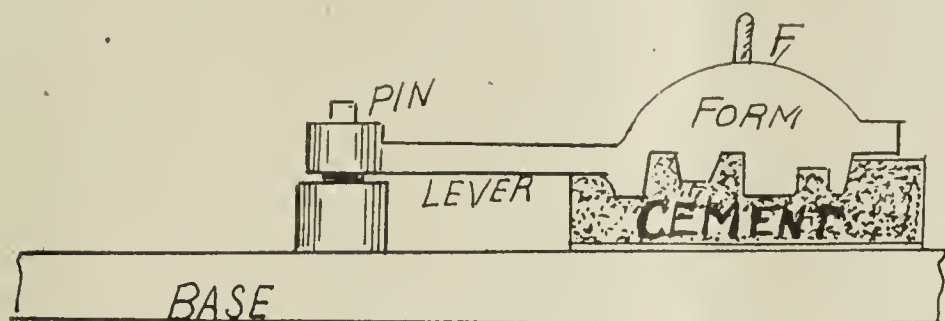


Fig 8

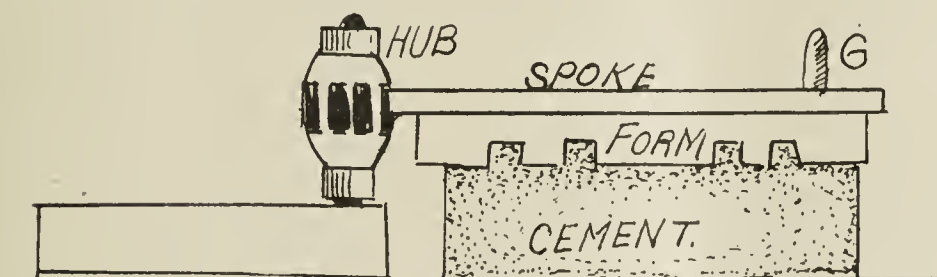


Fig 9

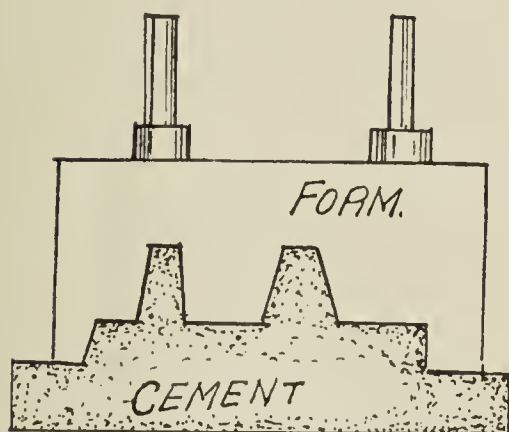


Fig 10

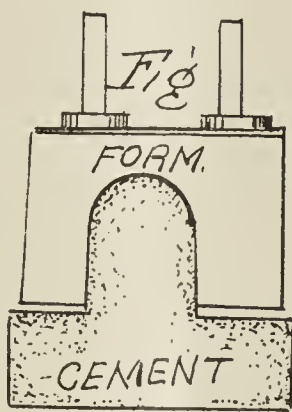


Fig 11

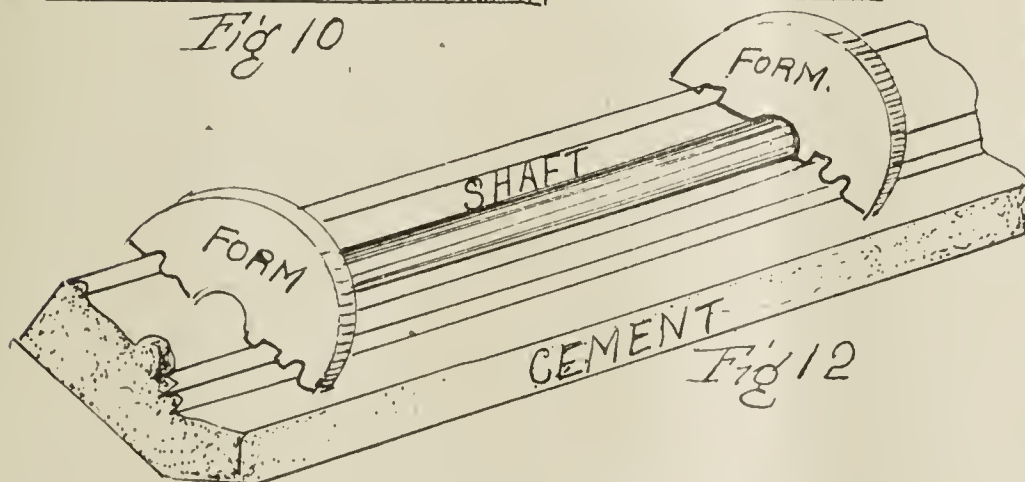


Fig 12

ure 6. The calculation is to slide the form back and forth on the mass of soft cement, gradually shaping the surface of the cement to the form of the design as shown.

The Cuban cement worker turns out some curious types of round patterns by a simple operation. Figure 7 explains how it is done. A

form on the circle, and drawing it around with the shaft as a center, depressing it at the same time into the soft cement, the grooves are created. As the turns are made, the cord is shortened by winding on the shaft. Therefore the curves are given the required inward alignment. In some cases the same

CONCRETE LINED SAFES FIRE-PROOF.

Steel safes lined with concrete afford a great measure of protection to the contents due to the fact that in forming the concrete, the water which is used to mix with the cement enters into direct combination with the cement forming a hydrate which sets and hardens. When subjected to a high temperature the hydrate is decomposed, and the water driven off as a vapor. This vapor enters the storage chamber of the safe, and keeps the contents moist, and thus preserves the same from being destroyed by the outside high temperature. The contents of concrete lined safes are sometimes found moist and damp due to the moisture thrown off by the concrete.

STONE VS. CONCRETE.

The stone cutters and curb setters of Michigan have protested against allowing a local concrete company to put in a concrete curb and gutter system on Pierce St., Detroit, and ask that the permit granted for the work be recalled by Mr. Haarer, commissioner of public works. The stone cutters acknowledged to Mr. Haarer that they were afraid that the concrete curb would prove a success and if this was so, they would be out of a job

because the curb was much cheaper than the stone curb. These craftsmen look upon the city as a sort of eleemosynary institution, and the commissioner of public works as their grand almoner to whom they appeal for charity at the expense of the property owners.

INCORPORATED.

The Best Bros. Keen cement plant at Medicine Lodge, Kans., was destroyed by a tornado last June, and is to be rebuilt at Sun City, Barber Co., Kansas, which is 28 miles north of West Medicine Lodge. John A. King, and other Cleveland, O., capitalists have acquired an interest in the company. The new plant is to be much larger than the old plant.

Mr. Edward Quebbeman has been appointed St. Louis agent of the Universal Portland Cement Co., with office in the Chemical Bldg., St. Louis. Mr. Quebbeman takes the place of Mr. J. C. Van Doorn, transferred to Minneapolis.

The P. & M. Cement Co., of New Jersey, has been incorporated to build a plant at South River, Middlesex County, N. J. Theodore Moore, financial editor of the New York Tribune, Pres. E. M. Carroll, Vice President of New Brunswick, N. J., B. Stevenson Gibson of New York City, Secretary.

The Southern railway is asking for bids for a seven story freight and office building, 100 by 800, at Atlanta, Ga. Bids for concrete construction will be received. Address Southern Ry., 1300 Pennsylvania Ave., Washington, D. C.

A chapter or two of frenzied finance is recited in a suit filed Thursday in the common pleas court by Anna M. Stentz against William Watts, from whom she seeks to recover \$5,000 that she invested in the Toledo Portland Cement company on the alleged fraudulent representations of Watts.

The plaintiff charges that Watts and others formed the company with a capital stock of \$500,000. They secured subscriptions for \$115,000. She asserts that without any consideration they voted themselves \$35,000 in cash.

Watts, she says, gave her 125 shares of stock because she bought 500 shares. Later she learned, she alleges, that he pocketed \$500 for making the sale. The company, she declares, is insolvent.

A CEMENT PLANT FOR BANGOR, MAINE.

John H. McLauchlan of Toronto, is promoting a cement plant enterprise for Bangor, Me. Mr. McLauchlan is largely interested in the manufacture of cement in Canada. The Bangor plant is to be capitalized from \$800,000 to \$1,000,000. The City of Bangor is asked to contribute a site of not less than 15 acres on the water front and exemptions from taxation for a period of ten years. Suitable limestone and shale exist a few miles below the city on the Penobscot river. It is proposed to bring the stone up the river to the site of the proposed plant which must be located on the river front. Mr. McLauchlan has visited Portland and Rockland and has been given encouragement for locating his proposed plant at both places. A party of New York and Canadian capitalists are to visit Bangor in furtherance of the enterprise when a public meeting is to be held and the proposition laid before the citizens. The promoters propose to deposit \$100,000 in four Bangor banks, \$25,000 in each bank as a guarantee of good faith on their part. The plant is to have a capacity of 4,000 bbls. per day.

Sixteen thousand three hundred and twenty-three tons of cement were imported into Uruguay in 1905, valued at \$237,437. The cement is branded in the name of the local dealers, English cement preferred. Cement sells at \$2.20 per 220 pounds, or 1 cent per pound. There is a market for cement block machinery at Montevideo, the capital of Uruguay.

U. S. Consul Alfred A. Winslow, of Valparaiso, Chile, reports that of the 41,955,300 kilos (kilo, 2.2 pounds) of cement imported into that Chilean port in 1905, 25,504,350 kilos came from Germany, 11,895,475 kilos from Great Britain, 1,800,925 kilos from the United States, and 1,475,775 kilos from Belgium. The selling price is \$2.75 to \$3.25 United States gold per 170 kilos, and the duty is about 22 cents per 100 kilos, including the weight of the package, which is generally a sheet-steel cask. In the rebuilding of Valparaiso, caused by the earthquake last year, an increased market for cement will be presented, in addition to a demand for structural steel. (Names of architects and dealers in Valparaiso are on file in the Bureau of Manufactures.)

The Adamant Cement Company has been incorporated with a capital of \$300,000 and the following New York men as directors: Abraham G. Sherwood, Charles S. Beardsley, Charles A. Falconi, C. Chetwood and Charles A. Heatley. The business office is Van Buren, Onondaga county, N. Y. Van Buren is located between Syracuse and Baldwinsville and is commonly known as Hardscrabble. It is a settlement of less than fifty people.

Austin, Tex., Sept. 13.—A permit to do business in Texas was granted by the state department to the Southwestern States Portland Cement company of West Virginia. Capital stock \$3,500,000. The filing fee was \$3,450. Dallas is the Texas headquarters.

Madelia Cement Tile company, Madelia, Watonwon Co., Minn.; capital, \$12,000; incorporators, A. E. Whiting, E. L. Brown, Charles E. Brown, E. R. Cisney, E. L. Cove, C. T. Dahl and J. E. Haycroft.

Bids for sidings for the Southwestern States Portland Cement Co. plant near Dallas, including about two miles of trackage.

The Huron Cement Co., of Alpena, Mich., is underway and machinery being installed.—Alpena News.

The Woods Co., Okla., Oklahoma Cement Plaster Co., of Alva, with \$500,000 capital stock. The incorporators are: D. B. Zimmer, S. F. Harris and D. A. Murphy, of Kansas City, Mo.; J. M. and Ben F. Bickel of Alva.

The Utah & Nevada Cement Plaster Co., of Salt Lake City, Utah, has been incorporated. John Sharp, president and Hyde Tingey, secretary, both of Salt Lake City.

The Huntington Stone Cement Co., of Huntington, W. Va., has been incorporated with a capital stock of \$10,000, to make concrete blocks, etc. H. M. Vredenberg, J. B. Arbourff, J. S. Stewart, and others, of Huntington, incorporators.

George P. Dieckman has been appointed chief chemist for the Northwestern States Portland Cement Co. (Cowham System) at Mason City, Ia. Mr. Dieckman was formerly connected with the Peninsular and Empire Portland Cement Co.

The Granite, Concrete & Fibre Plaster company, which was burned down several days ago, will rebuild. Lieutenant Governor Harper, is president of the company, of Boulder, Colorado.

The Art Portland Cement plant at Kimmel, Ind., has shut down. The company has been making a white Portland cement.

CONCRETE COMPANIES AT HOUSTON, TEX.

The Concrete Construction company; capital, \$10,000; output, \$50,000; employes, 15; annual pay roll, \$12,000.

Sargent concrete works (figures for 1906): capital, \$5,000; output, \$20,000; employes, 6; annual pay roll, \$3,000.

Houston Cement, Stone and Paving company; capital, \$6,000; output, \$35,000; employes, 20; annual pay roll, \$12,000.

The Fall River, Mass., Brick & Concrete Co. has been incorporated with a capital stock of \$40,000, to manufacture bricks and blocks of all kinds. Wm. Dacey, president. A tract of five acres of land on the east side of Meridian street, between that street and the North Watuppa pond, has been purchased, and it is intended to erect at once a plant for the manufacture of brick.

Cambridge City, Ind., Aug. 31.—One of the growing industries of this city which has attracted but little attention is the plant owned by the Ideal Cement Block company in East Cambridge, which has been operating for four seasons and has been steadily growing in output each succeeding year. With the addition of six new molds for ornamental cement veranda work, the plant will be one of the most complete in Wayne county. These molds have been ordered, and are the most up-to-date pattern, this being an entirely new line of cement building material.

The City of Cleveland has decided to erect concrete voting booths in several wards to displace the corrugated iron booths. The first of these concrete booths was erected on Detroit Ave., N. W., near West 30th St.

The Missouri Portland Cement Co., of Kansas City, Mo., has been organized to erect a 1,000 barrel plant four miles from Weston, Platt Co., Mo. T. J. Ridenburgh, 919

Ridenburgh St., St. Joseph, Mo., is president of the company.

Meyer, Wilson & Co., of Portland, Oregon, have chartered the French bark Emilie Galline to bring a cargo of cement from London to Portland. She will begin loading in October and is expected to reach the Columbia river early in March. She will be able to handle about 2,500 tons.

El Paso, Texas.—Southwestern Portland Cement Co. will proceed with construction of its proposed plant. The daily capacity will be 1,600 barrels of Portland cement, but size and cost of building or cost of machinery have not been fully decided. The Cement Engineering Co., of Los Angeles, Cal., is engineer and architect in charge. A. Courchesne is general manager of Southwestern Company.

Some mechanics in the building trades are not inclined to accept this modern method of construction and adapt themselves to it. Although concrete is accepted by all authorities, and has been subjected to all sorts of tests, there is a tendency in some quarters to criticize the new construction, and there is an eager desire to have doubts cast on the durability of the material. Men who have been bricklayers and masons all their lives do not want to change their trades or confess that what for centuries they have done well can be done in other and less expensive ways.

Built Entirely of Concrete.

Such progress has been made in the use of concrete that in some instances entire buildings, even the exterior walls, are built of it. A notable instance of this type is the building being built by Mrs. Anne Weightman Walker for the General Electric Company, on Washington avenue below Thirteenth street. Not a single stick of lumber, or a brick or a stone has been used in its construction.

Some of the big concrete structures in course of erection are a warehouse for the Acme Tea Company, at Fourth and Willow streets; a factory for Frank Schoble & Co., at Tenth and Oxford streets; the Boyertown Burial Casket Company's building, on Arch street west of Twelfth; No. 914 Walnut street and No. 1214 Arch street, for Abner H. Mershon; a warehouse for the Smith, Kline, French Company at Fifth and Appletree streets; a plant for the New York Pie Baking Company, at Twenty-fifth and

Lombard streets; a factory for the H. H. Sheip Company, at Sixth street and Columbia avenue; the Harrison building, on Walnut street below Tenth; a big plant for the Wolf Realty Company, at Twelfth and Callowhill streets, and an immense storehouse for the Locust Realty Company, on the site of the Free Quaker Burial Ground, on Fifth street below Locust.—Philadelphia Record.

The Des Moines Concrete Co., of Des Moines, Ia., is doing a rushing business. It has outgrown its old quarters where ten men have been employed. The demand for concrete blocks and ornamental stone has been so great as to compel the building of a large plant in South Des Moines where the company expect to employ up to 100 men. The company has a capital of \$25,000.

Concrete for telegraph poles is the latest use of which the mixture of cement and stone is to be attempted. W. D. Boyce, the publisher, is conducting the experiments.

He is planning to build an electric power line between Marseilles and Peru via Joliet and will erect during the fall a line of concrete poles between Marseilles and Ottawa and await the result of the winter's action upon them.

If the use of concrete for telegraph, telephone, and electric light and power poles proves a success, it will mean the end of the wooden pole as it is asserted that the concrete poles will cost less than those of wood and will last twice as long. The experiment is of deep interest to the wire companies.

A permit to do business in Texas was today granted the Southwestern States Portland Cement Company, chartered under the laws of West Virginia and having a capital stock of \$3,500,000, with principal Texas office at Dallas, Benjamin Larue, agent.

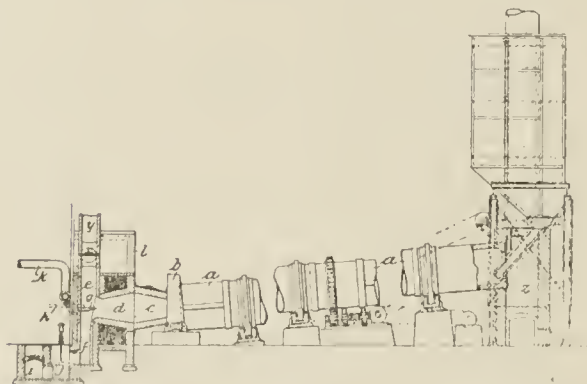
Steel frame wire mesh concrete doors are now on the market. The steel frame in these doors carry the hinges and lock. The steel frame and the wire mesh constitute the frame upon which the concrete is molded. With the growing scarcity of wood, concrete must in the near future get its fair share of the door business. These doors may be painted to resemble wood finish.

U. S. PATENTS RELATING TO CEMENT AND CONCRETE.

864,068. Manufacture of Cement and Other Products. August P. Bjerregaard, Mineola, N. Y., assignor of one-half to Robert C. Mitchell, Mount Vernon, N. Y. Filed May 7, 1907. Serial No. 372,431.

7. A process for moderating the intensity of a blast flame used in heating cement material, consisting in introducing into the said flame at or near its point of origin, a suitable proportion of a finely pulverized solid material capable of generating in the flame a non-combustible gas with the absorption of heat, and subsequently transforming the same into a combustible gas.

864,045. Method of Burning Cement in Rotary Kilns. Benjamin H. Thwaite, London, England, assignor to Thos. C. Fawcett, Limited, Leeds, England. Filed Feb. 2, 1907. Serial No. 355,448.



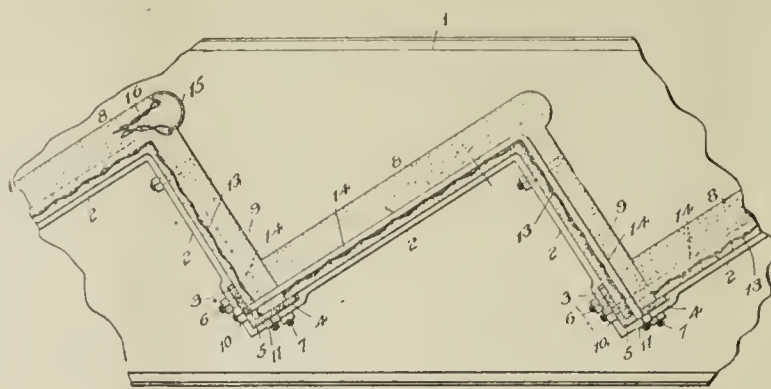
No. 1.

2. The process of operating a cement kiln, which consists in separating a given volume of combustible producer gas into two streams utilizing one of the said streams to heat a stream of air, forcing together the said stream of pre-heated air and the remaining stream of gas from opposite directions, injecting pulverized fuel crosswise of the said streams at the point where they impinge against each other and in advance of the point where the mixture is ignited, and forcing the cement material into the said ignition zone from the opposite direction from the said mixture to meet the flame.

863,760. Fireproof Stair Structure. Edward E. Schachner, Denver, Colo. Filed Apr. 16, 1907. Serial No. 368,477.

1. As a new article of manufacture, a tread and riser for stair-steps molded of plastic material as an entirety and means whereby the inner edge of the tread and the lower edge of the riser are secured to the walls of the stair stringers.

2. As a new article of manufacture, a tread and riser for stair-steps molded together of plastic material the tread and the riser having an embedded continuous rein-

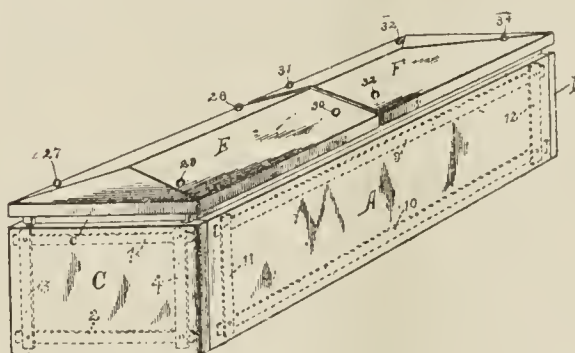


No. 2.

forcing metallic trellis frame around the angle thereof.

5. In a fireproof stair structure, and in combination a pair of stringers each having flanges on their inner walls corresponding to the angles of the steps, an integral tread and riser molded of plastic material the counterpart of the stringer flanges, and means for securing both ends of the integral tread and riser to the angles of said flanges.

864,241. Cement Burial-Vault. William W. Gipe, East Germantown, Ind., assignor of one-half to Amos E. Ehle, East Germantown, Ind. Filed Feb. 25, 1907. Serial No. 359,135.



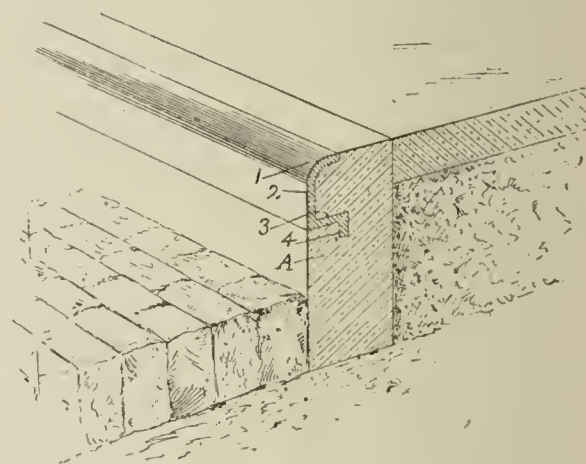
No. 3.

In a cement burial vault, the combination of side and end pieces having their upper edges provided with external rabbets forming tongues, said tongues being beveled on their outer edges, and a top having an angular groove formed around the marginal region of its under surface for the reception of said tongues, said groove being of a depth less than the height of the tongues, whereby an outward facing cement-receiving channel is formed between the marginal region of the top and the bottom of the rabbet, and the relative angles of said groove and the tops of said tongues being such that the beveled faces of the tongues and the opposed faces of the groove flare outward away from each other.

864,276. Metal Nosing for Concrete Curb and Other Structures. Henry H. Wainwright, Philadelphia, Pa. Filed Feb. 7, 1906. Serial No. 299,880.

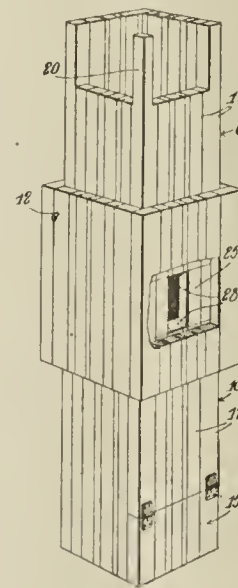
In a metal nosing for concrete curb, the combination of the curved

corner 1, body 2, web 3 perpendicular to said body 2, and adapted to enter the mass of concrete and the head 4 on said web adapted to interlock with said concrete, substantially as described.



No. 4.

864,767. Building-Mold. John D. Bickford, Cleveland, Ohio. Filed Apr. 9, 1907. Serial No. 367,199.



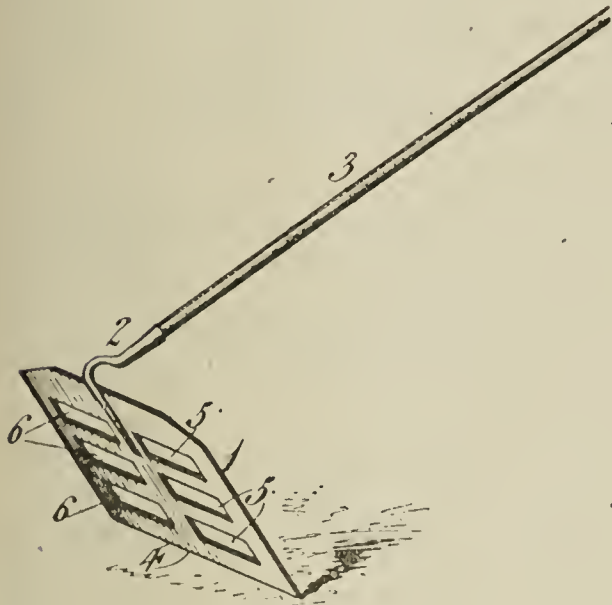
No. 5.

1. A mold for cement or concrete construction, comprising sections placed endwise with respect to each other and an outer casing inclosing the adjacent ends of the sections, said sections and casing being formed of a plurality of staves extending lengthwise beside each other, the staves of the sections and casing being of similar widths and capable of being removed or replaced to equally vary the size of said parts.

4. A mold of the kind described, consisting of sections placed end-

wise and spaced with respect to each other, the adjacent ends being undercut, filling pieces located between said sections and retained under said ends, and an outer casing surrounding said ends and the filling pieces.

865,150. Mortar Mixer or Hoe. Niels Anderson, Philadelphia, Pa. Filed Apr. 29, 1907. Serial No. 370,769.



No. 6.

1. In a device of the character described, a blade having a plurality of rows of apertures therein in different horizontal planes, there being a uniform width of the solid portion of said blade between said apertures, and a handle secured to said blade.

BOOK NOTICE.

The Engineering Experiment Station of the University of Illinois has just published Bulletin No. 13: "An Extension of the Dewey Decimal Classification Applied to Architecture and Building." This greatly extended classification has been in use in a more comprehensive form in the department of architecture for many years, but it has never before been published. It forms a supplement to the extended classification applied to the branches of engineering previously issued in Bulletin No. 9.

It is preceded by a very brief explanation of the exceedingly valuable system invented and introduced by Dr. Melvil Dewey for the classification of books and literary materials, but which has since been found to be the best known method for arranging all tangible things and ideas. For the convenience of persons not fully conversant with the system, and for finding the proper numbers quickly, a relative index of subjects has been added. In its present form it is believed that this bulletin will prove useful to architects, engineers and constructors in classifying books, pam-

phlets, articles in periodicals, data and all other material relating to architecture and construction.

Copies may be secured upon application to the director of the Engineering Experiment Station, Urbana, Illinois. L. P. Breckenridge.

The Pennsylvania railway tunnels entering New York City will be lined with hollow glass brick so laid as to form continuous ducts which drain into a 2-inch trough in the concrete foundation at the base of the glass lining, and thus carry off the condensation formed in the interior of the hollow brick. Currents of air will be forced through these ducts. The temperature of which will be changed to conform to the temperature of the air in the tunnel and thus limit in a great measure the condensation within the ducts formed by the hollow glass bricks.

CAPACITY OF THE NO. 9 STYLE "K" GATES BREAKER BUILT BY ALLIS-CHALMERS COMPANY.

When the No. 9 Style "K" Gates Breaker was first designed there was considerable doubt as to whether the machine was not of too large capacity for ordinary use. Many of the larger crushed stone companies installed crushers of this size, however, even in places where a smaller size would have had sufficient capacity, simply because of its large receiving opening and consequently the reduced cost of quarrying.

Until quite recently the capacity of a No. 9 crusher was commonly said to be limited only to the amount of stone that could be fed to it. But, owing to the increased demand for stone within the past few years, quarrying methods have improved; and, as a consequence, some of the owners of this size of crusher have been able to keep the No. 9 constantly supplied with stone.

It must be remembered that the capacity of any crusher will depend on the character of the material fed to it and the size to which it is to be reduced. In one case, recently, an Allis-Chalmers machine crushed 595 tons of iron ore, producing a three inch product, in thirty minutes, or at the rate of 11,900 tons in ten hours. Such a capacity could not be maintained for a full working day, but only because of the impossibility with present methods of supplying the crusher with ore continuously for any long period.

When crushing a hard "blocky" limestone, the capacity of a stan-

dard Allis-Chalmers No. 9 Breaker average 250 tons per hour to a four-inch product, this size being the one commonly demanded by steel producers for "flux."

J. C. Van Doorn has been appointed northwestern sales agent of the Universal Portland Cement Co., with office in the Security bank building, Minneapolis, Minn.

CEMENT ON THE FARM.

With the wonderful development of the Portland cement industry during the past fifteen years, comes the most ideal building material ever produced.

Prof. H. M. Bainer of the chair of farm mechanics at the Colorado Agricultural College makes the following valuable suggestions in regard to its use:

Cement.—Use nothing but the best cement that can be obtained. It should be in a fine, powdery condition and contain no lumps. Cement should be stored in a dry place, as dampness is an element of great danger.

Sand.—The sand used should be clean, sharp and not too fine. It should be free from loam or clay, as these will tend to destroy the adhesive quality and to retard the setting of the cement. Clay mixed with the sand may be removed by washing.

By sharp sand we mean that the edges of the grains must be sharp and not round or worn off, as will often be the case with sand found in the bed of a stream. Coarse sand is better than fine sand. Fine sand, even if clean, makes a poorer mortar or concrete and requires more cement to thoroughly coat the grains. A large proportion of the grains should measure from 1-32 to 1-16 of an inch in diameter. Some fine sand is necessary to help fill the spaces between the larger grains, thus saving cement.

Water.—The water used should be clean and free from acids and alkalis. For making the best concrete, add just enough water so that when all the concrete is in the form and is well tamped, moisture will show on the surface. The tamping is a very important operation and the quality of the work is dependent upon how well this is done. Unless this is thoroughly accomplished the concrete is likely to be honeycombed and imperfect, especially near the forms.

Proportions.—For ordinary farm construction, as the making of floors, walls, walks, gutters, etc., the following proportion is to be recommended: One part cement, 2

1-2 parts clean loose sand and five parts of loose gravel or broken stone. For floors this should be tamped in to a depth of from five to eight inches. This should be finished with a surface coat 1 to 1 1-2 inches in thickness, composed of 1 part cement and 1 1-2 to 2 parts of clean, coarse sand, mixed. Nearly all constructions which come in contact with water should be covered with a mortar at least as rich as the proportion last named. For engine foundation, 1 part cement, 2 parts sand and 4 parts broken stone is best.

In estimating the amount of material necessary for a certain construction, do not make the mistake of thinking that a mixture of 1 barrel of cement, 2 1-2 barrels of loose sand and 5 barrels of gravel or broken stone will make 8 1-2 barrels of concrete. The sand will fill the voids between the gravel or broken stone and the cement fills the voids between the grains of sand. The total amount of concrete will be but slightly more than the amount of gravel or broken stone used.

To make one cubic yard of concrete of the following proportions—1 part cement, 2 1-2 parts sand and 5 parts gravel—requires about 1 1-4 barrels of cement (5 sacks), 3 1-4 barrels of sand and 6 1-2 barrels of gravel.

Mixing.—Be very careful in measuring the proportions. Mix the concrete as near the place it is to be used as possible. Use as soon as mixed. Do not mix too much at once.

Measure the sand first and spread it in an even layer in a mixing box, place the cement on top and turn it with a shovel at least three times. Then add the broken stone or gravel which has previously been wet and turn the whole at least three times. Begin to add the water on the second turning, not too much at once. A sprinkling pot is better than a hose for adding the water, as it does not wash away the cement.

Concrete work should be avoided in freezing weather, as frost damages it. Where it is absolutely necessary to do work at this time, a small amount of salt added to the water will prevent freezing; this does not damage the concrete, where used in small quantities.

An objection is sometimes raised that concrete floors and walls are too smooth and become slippery when wet. This fault is largely due to the fact that the finishing surface was completed with a steel smoothing trowel instead of a wood trowel,

or smoothing board, which would have left the surface rough. This fault is also overcome in a great measure by dividing the wearing surface into small squares about four inches on each side, by means of triangular grooves three-eighths of an inch in depth. This not only

makes a neat appearance, but furnishes a good foot hold for stock.

H. M. Bainer.

Colorado Agricultural College.

The citizens of Forest, Ill., are raising money to build a cement drinking fountain.

Hollow Concrete Block Building Construction

By Spencer B. Newberry

Illustrated. Covers in detail. Materials, cement and aggregates. Process of manufacture to obtain the best results. Waterproofing mixtures. Classification of machines. Hand and machine tamping. Crushing strength. Handling and storing. Table of mixtures. Strength with sand and gravel, or limestone screenings. Cost of materials. Fine sand mixtures. Absorption, porosity and permeability. Color mixtures. Estimates, labor and materials. Comparative cost of brick and concrete blocks laid up in walls. Reproduction of concrete in various patterns, shapes and designs.

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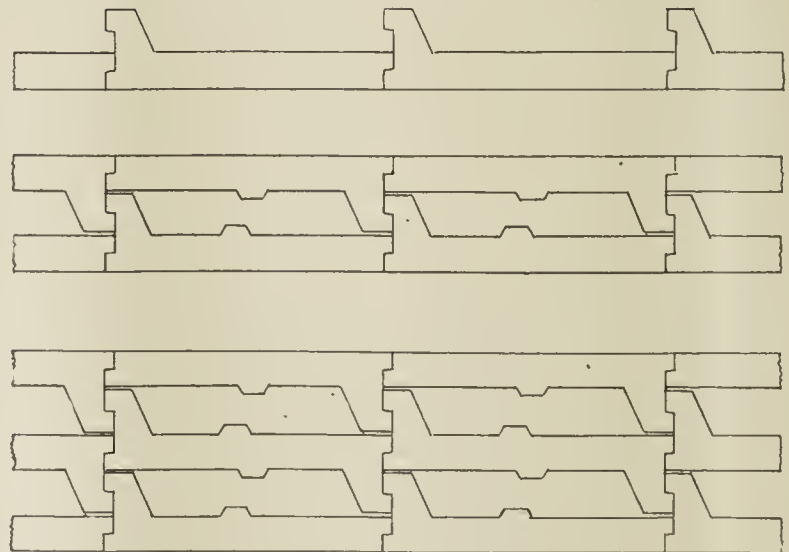
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Box 74, care of Cement & Engineering News

Position Wanted—Eastern Cement Chemist desires to make a change. Competent to take charge of any plant. References from past and present employers. Address C. C. E., care Cement & Engineering News.

Wanted Position as assistant chemist by a young man with college education and six months' experience in cement laboratory. Can give best of references. Address M. E. P., care Cement & Eng. News.

WANTED—Experienced superintendent for cement plant, materials rock and clay; liberal salary for successful, competent man. Apply with references, Box 54, care Cement & Engineering News.

FOR SALE—One Stewart Concrete Block Machine, latest type, complete, new; price \$125, freight prepaid. Wert Schmacker, Webster City, Ia.

FOR SALE—A1 design of Concrete Mixing Machine, semi-automatic; patent applied for. Wert Schmacker, Webster City, Ia.

WANTED POSITION—As superintendent or manager by an experienced operator in both wet and dry processes. Address I. M. T., care Cement & Engineering News.

CEMENT CHEMIST—technical graduate—B. S. degree, wishes change of location; one and a half years' experience; both physical and chemical; would become assistant to manager in cement mill. Address G. D., care Cement & Engineering News.

Wanted Chemist for large Portland Cement Mill, dry process, with experience. State age and salary expected. Address N. St., care Cement & Engineering News.

SITUATION WANTED.

Chief chemist of four years' experience, with college training; presently employed but desires change of location. Desirable references can be furnished. Address D. B. O., care Cement & Engineering News.

Chemist at present in charge of slurry process, desires change as chief or assistant. Address B. M., care Cement and Engineering News.

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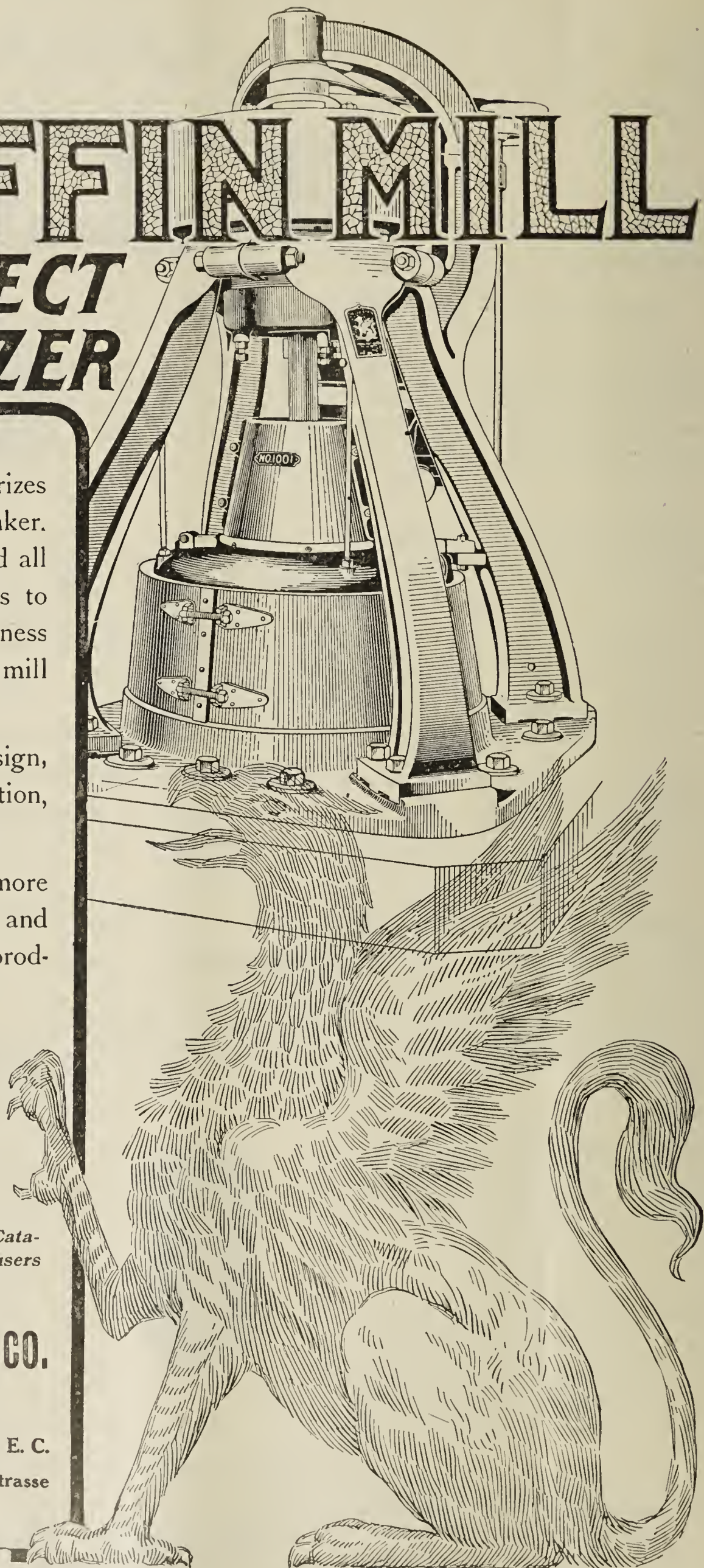
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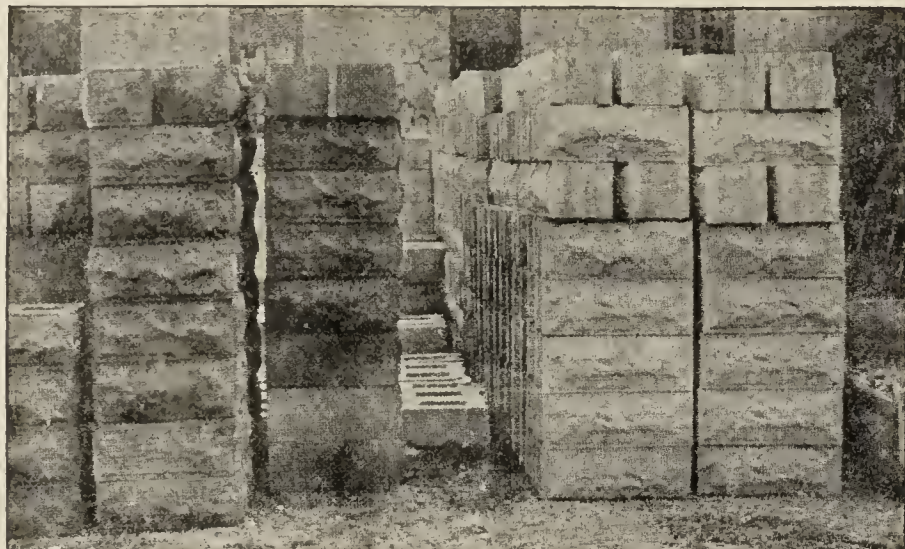
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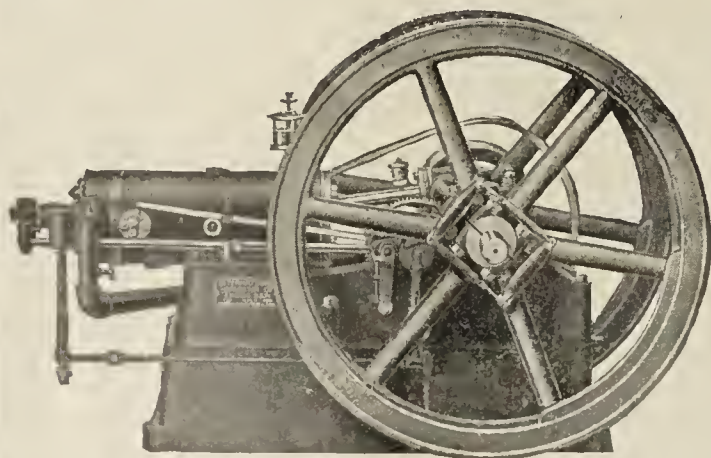
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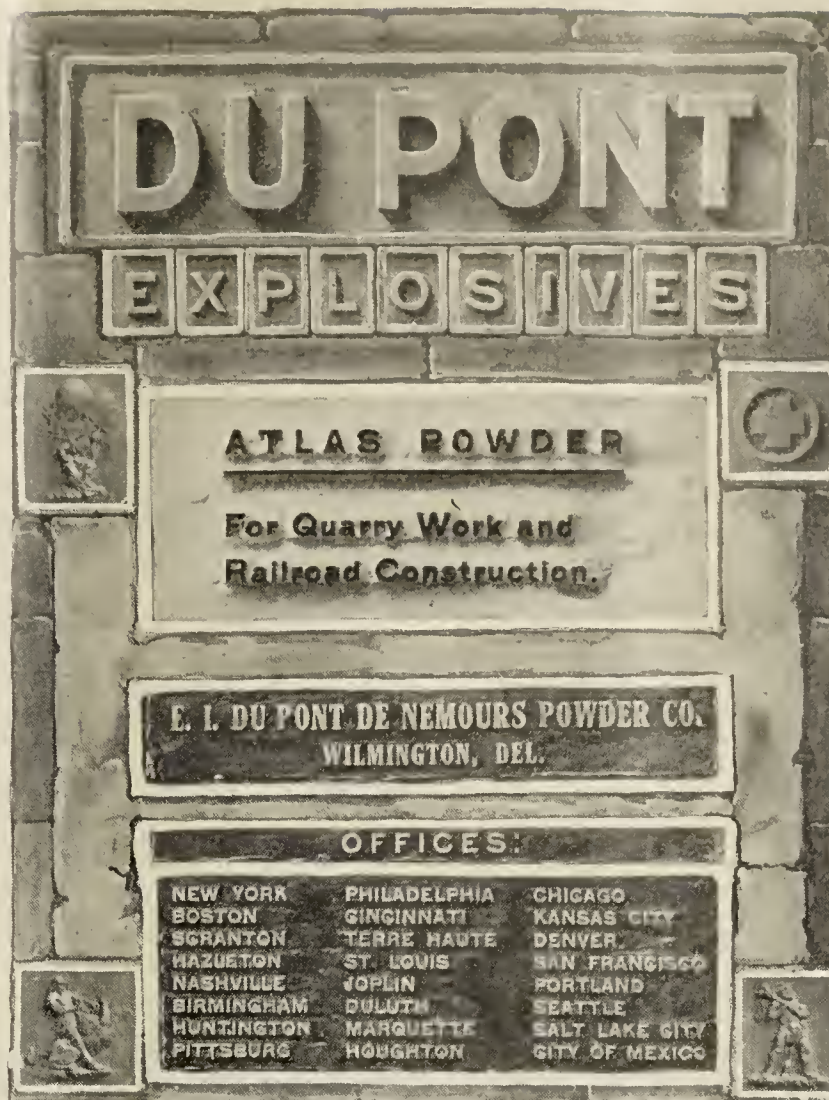
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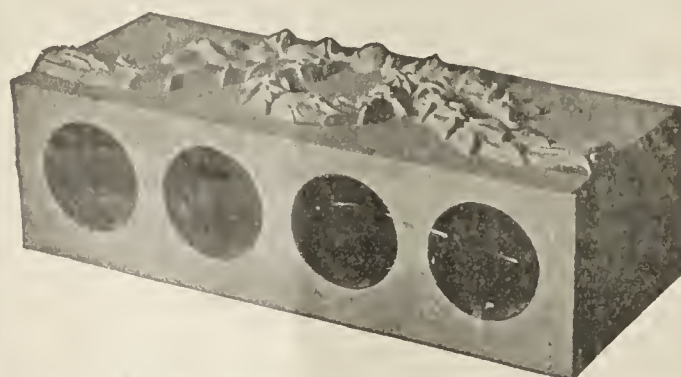
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(PUBLISHED MONTHLY)

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CHICAGO, OCTOBER, 1907.

CORRESPONDENCE.

We solicit correspondence on all matters of general interest to the cement trade in all its branches. Engineering notes, public improvements, and facts and opinions drawn from practical experiments will be welcome.

CEMENT EXHIBITIONS.

The great strides made in the use of cement have been so rapid that few people can realize its wonderful growth; therefore the necessity of collecting together for display in the form of exhibitions under a single roof, the new machinery and labor saving devices used in the fabrication of cement products, as well as the approved machinery which has become standard in certain special lines of cement products. Here the architect, the engineer, and the contractor can take in at a glance the new wrinkles which the year has produced in the use of cement. The manufacturer of cement machinery and appliances can here meet customers from every part of the country; thus these exhibits bring the manufacturer and consumer together. The manufacturer therefore cannot afford to miss the opportunity of installing his machinery in these exhibits, while the concrete worker can pick up much useful information, and absorb new ideas which qualify him to assume large responsibilities, and widen his field. The cement industry has shown a larger growth in the last few years than any other modern industry. Being thus full of life and vigor, it becomes the manufacturer of Portland cement products and machinery to come to the front, and make creditable displays at cement exhibits.

CEMENT RATE TO CALIFORNIA.

The Southern Pacific railway has reduced the rate on cement from Minnesota to California terminals. The new schedule cuts the price in

car load lots of not less than forty thousand pounds from 44 1-2 cents to 43 cents per hundred pounds. This new rate will go into effect immediately and is applicable via Council Bluffs and Ogden in connection with the St. Paul or the Chicago Great Western and the Union Pacific.

John A. Cox, of Vincennes, Ind., reports that his firm alone has sold nearly 25,000 barrels of cement in the past year in this market alone. As there are a number of other dealers, it will be seen that the amount of cement being used into local improvements is very extensive.

THE PAVEMENT OF THE STREETS IN BERLIN.

According to a recent report the surface of the streets of Berlin amounted to an aggregate of 7,449,604 square yards, of which 4,521,019 square yards were paved with stone; 2,857,304 square yards were paved with asphalt; 120,947 square yards were paved with wood; 149 square yards were paved with slag; 179 square yards were paved with concrete. Of the total, 93.7 per cent. come under the heading of better "material," whilst 6.3 per cent. were of inferior kind. Of the stone pavement, 1,266,984 square yards were maintained by the street-tram companies, and 3,257,030 square yards by the municipality. The tramway companies pay the cost of the renewal and maintenance for a surface of 12 in. from both sides of each rail. The new stone pavement is generally made with sets resting on an 8-in. thick layer of broken stone, the interval between the sets being filled with cement. Most of the stone used is Swedish granite, less frequently Bavarian and Siberian granite, Belgian diorite, Savonian porphyry. Of the asphalt pavement, 1,085,301 square yards were maintained by the tramway companies or contractors, etc., 1,772,003 square yards by the municipality. Natural asphalt is used, which rests on a layer of concrete 8 in. thick. The layer is 2 1-2 in. thick as laid, but is compressed to 2 in. thickness by rolling. The contractors are bound to maintain the asphalt pavement for four years without any remuneration and for a period of fifteen consecutive years at a fixed rate of payment. Artificial asphalt has hitherto not proved satisfactory. For wood pavement Australian hardwood is now almost exclusively used.

NOTICE.

Wm. Frank Hall, who for the past seven years represented the Bradley Pulverizer Co. in the sale of the Griffin Mill, has resigned and accepted a position with the Lehigh Car, Wheel & Axle works to further the sale of the Fuller-Lehigh Pulverizer Mill. Mr. Hall will be located at 111 Broadway, New York City, Trinity Bldg., where the Lehigh Car, Wheel & Axle Works have opened an office.

GERMANY'S COLOR WORKS.

There are 31 aniline color works in Germany, but the bulk of the trade is in the hands of five firms, forming two large combinations. The combined nominal capacity of these five firms is about \$24,000,000, and the net annual profits £9,680,000, 60 per cent or \$5,808,000 of which is paid in dividends, the remaining 40 per cent going to depreciation and reserve. The average dividend of the aniline dyeworks has exceeded 20 per cent for years past, and the dividend paid by individual firms has in some cases exceeded 30 per cent. The firm of Bayer alone employs 5,200 work-people, whilst the Badische Anilin and Soda Fabrik employs 7,251. The average working day is nine hours in the case of the first-mentioned firm, and ten hours in that of the second, which latter, in 1905, paid an average wage of 4.01 marks per day, as against 3.38 marks in 1895. The Badische firm began business in 1865, and started with only 40 men.

FUSING RARE METALS.

A patent recently taken out by Herr von Piram, and Messrs. Siemens & Halske, of Berlin, covers an apparatus in which tantalum and its allied metals can be melted, so as to obtain a homogeneous product with the aid of cathode rays. The device consists of a glass globe fitted with metal caps, which are cemented on air tight in position at the top and base. The upper cap is made a cathode, and is connected to a concave plate for the omission of cathode rays. The lower plate is the anode, and carries a small receptacle for the metals at the focus of the rays. The glass globe is exhausted sufficiently for the purpose in view, and the rays are deflected over the whole mass of metal in such fashion as may be necessary to ensue complete fusion, by means of an external magnet. It is stated that the electrical energy consumed is very efficiently utilised and that the apparatus will work with alternating currents of such high pres-

tures as 50,000 to 100,000 volts. The glass receptacle can also take the form of a bell cover standing on a flat plate, two electrical connections disposed convergently, being fixed at the upper part of the glass. Each connection terminates in a concave disc, fastened at such angles, respectively, as to have a common focus, and either disc can be made cathode. In this case the metal is supported in a dish, carried from the bed-plate, where the air outlet is also fixed.

STATISTICS OF CEMENT INDUSTRY IN 1906.

By L. L. Kimball.

(Continued from Sept. number.)

The Portland-Cement Industry, by States.

Alabama.—In 1906 there was but one active Portland-cement factory in Alabama, the new plant of the Standard Portland Cement Company not having been completed and started until just after the close of the year. The active plant ran continuously for the greater part of the year, having been idle for a short time only, owing to a lack of car service. The plant produced practically double the quantity of cement made during 1905. A project to establish a large plant for the manufacture of Portland cement at Ragland is reported, but the erection of the factory is not yet commenced.

Arizona.—The only cement plant in Arizona, that of the United States Reclamation Service is located at Roosevelt, and made its initial run in 1906, producing a quantity of Portland cement sufficiently large to fill the stock bins, when, by reason of that fullness, as well as of a shortage in oil for fuel, it shut down for a time. The success of the plant has apparently stimulated the hitherto unworked cement industry in this State, as a plant for the production of Portland cement, it is reported, is about to be established at Prescott.

Arkansas.—There is but one cement plant in Arkansas, and its latest production of Portland cement was made in 1903. A plan is now being formed to modernize the plant, beginning with a capacity of 1,500 barrels a day, and building with the expectation of doubling this output very soon after the mills are started.

California.—The cement industry in California was very prosperous in 1906, notwithstanding the earthquake. The three active plants reported in 1905 were in operation in 1906, and an additional plant was completed at Davenport, but did

not produce any cement until the year had closed. One of the two plants near San Francisco ran ahead of its production for 1905, and the other fell slightly behind by reason of a strike among the workmen. Both of these companies suffered the loss of their offices, which were located in San Francisco, but their factories were not injured. One factory installed ten additional kilns. The plant at Colton, which has offices in Los Angeles, ran far ahead of its production for 1905. Two of the three active companies in the State sold their product at prices in advance of those for 1905. One company in the State is about to build a large plant in Washington. The new plant at Davenport opened with a capacity of 6,000 barrels a day, which output is to be doubled after a short run. All cement manufacturers in this State use oil as fuel.

Colorado.—The single cement plant in Colorado ran on full time throughout the season. The overhauling and remodeling, accomplished early in 1906 resulted in a much increased production, the figures showing larger results than those of 1905 as to both quantity and value per barrel. There is no immediate prospect that other mills will be erected in this State and no new projects are reported, the project attempted in 1905 having been abandoned.

Georgia.—Better prices, a greatly increased output, and a successful season formed the record in 1906 for the Portland-cement plant in Georgia. The company owning this factory made practically the same record in 1905, when it greatly increased its production over that of the preceding year. The output reported each year since the opening of the mill has shown an advance over that for the preceding year.

Illinois.—Four plants were engaged in the production of Portland cement in Illinois in 1906, and their output was nearly 2,000,000 barrels. The record in this State was in accord with the almost universal rule of better prices and increased output for 1906. The production of each of the four plants was greater than that for the previous year, although the increase was not in the same ratio.

In October the Universal Portland Cement Company took over the cement plants and cement business of the Illinois Steel Company. The new company is building an additional plant in Indiana and a new one in Pennsylvania, each of which will be in operation early in 1907. All the factories operated by this

company make Portland cement from slag and limestone, which, after being thoroughly dried and ground together in proper proportions, are burned to clinker in rotary kilns.

The plant reported to this Bureau by the Sandusky Portland Cement Company as about to be erected at Dixon, Ill., is still under construction and will probably be in operation in 1907.

Indiana.—The Portland cement industry is a growing one in Indiana. The production in 1906 was the output of six plants, and was sufficient to keep Indiana in the third place among the Portland cement producing States, a rank attained only in 1905. The new plant at Speeds was in operation, and the combined production of the State amounted to nearly 1,000,000 barrels more than that for 1905. Of the five older factories, all but two ran ahead of their output in 1905. One of these two reported the same production as for 1905, but the price obtained was greater. The second plant ran considerably behind its previous record. The other three made from 100,000 to 700,000 barrels more than in 1905. There were no important shut downs during the year, the necessary repairing being the greatest cause of brief delays in manufacture. Only one entirely new factory is reported for Indiana, though in 1907 there will be two, and possibly three, additional plants in operation. The first new mill is being erected by the Universal Portland Cement Company at Buffington near its No. 1 mill. This older plant was a part of the cement interests of the Illinois Steel Company, all of which were taken over in 1906 by the Universal Portland Cement Company. The second mill, located at Kimmel, Ind., which is just completed and now in operation, will report a production at the close of 1907. The third plant, which is a possible producer for 1907, is a nearly completed mill at Marengo.

Indian Territory.—For the first time Indian Territory appears in the text of the cement report. Two cement plants in this Territory are now being erected, one at Ada, by the Oklahoma Portland Cement Company, and one at Dewey, by the Dewey Portland Cement Company. The first company expects to have its mills in operation late in the summer or early in the fall of 1907. Both the plant and its main offices will be located at Ada. Machinery will be installed for a production of 1,000 barrels of cement a day; but the buildings will be

erected to accommodate a 2,000-barrel plant. The factory is located only a short distance south of the Canadian River, in the southern portion of the State. The second company has built its plant at Dewey, and has constructed it with a capacity of 2,500 to 3,000 barrels of Portland cement a day. The mills will be in active operation in the fall of 1907.

Iowa.—Like Indian Territory, Iowa appears for the first time in this report as a cement-producing State. The Northwestern States Portland Cement Company is now constructing a large plant at Mason City for the manufacture of high-grade Portland cement. The factory is to have a capacity of 3,000 to 3,500 barrels of cement a day, and will be built in the general fashion of the mills owned by this company at Independence, Kans. Twelve large rotaries, 110 feet long, will be installed, and the grinding machinery will consist of ball and tube mills, Kent mills, etc. The plant will be finished and ready for work by October, 1907.

Kansas.—Each of the four Portland cement plants in this State produced an output in 1906 which was in advance of that for the preceding year. One of these plants made more than eight times as large a quantity in this, its second year, as it made in 1905, while the other year-old plant made over fourteen times more than in its initial year. In 1905 the older plants naturally produced more cement than the new ones, and therefore their increase in 1906, although marked, is not so far in advance of the preceding year's output as that of the new mills. Three of the factories ran on practically full time during 1906, and one was idle for nearly six months repairing and remodeling. It is reported that six new cement plants will be in operation or completing construction in 1907. One is to be located at Iola, and will probably start during the fall or early in the winter. One is to be at Fredonia, and will perhaps be in running order by June at the latest. This company will start with two kilns, at least 110 feet long, and the buildings will all be constructed with a view to enlarging the capacity of the plant later. The third plant is to be at Elk City, in Montgomery County, and will have a capacity of about 2,000 barrels a day. Preliminary excavation and grading is now being done, but the mills will not be ready for work before 1908. The fourth plant will be erected about 3 miles east of Mapleton, in Bourbon County. It will start with

a capacity of about 2,000 barrels of cement a day, with six kilns, 125 feet long by 8 feet in diameter; the mills will be in operation late in 1907 or early in 1908. The fifth plant is under construction at Yocemento, and is to begin producing Portland cement in November, 1907. The mills will start with two rotaries, each 125 feet in length. Oil will be the fuel used, and shale, lime, and chalk the materials. The sixth of the new plants is being built at Bonner Springs, and its first section, capable of producing about 800 barrels of Portland cement a day, will be in working order by January, 1908. The other section, which will exactly double the capacity of the mills, will be completed later in that year. With more than double her present number of plants, Kansas bids fair to reach a high place in the list of cement-producing States, for already she has risen from a record of no Portland cement production prior to 1900 to the sixth place in the list in 1906, with over 3,000,000 barrels to her credit.

Kentucky.—Only one plant was actively engaged in the production of Portland cement in Kentucky in 1906, and it made a remarkably good showing for its second output. There was no cause for idle mills, and the plant was active all the year, using its four rotaries constantly.

A new plant is now under construction at Stanton, in this State, which will have its main offices in Lexington. It will not become active before the fall of 1907. The property of this company is nearly 1,000 acres in extent. The fuel for supplying light and power is to be natural gas, of which there is an abundant supply. Transportation facilities are excellent.

Michigan.—The Portland cement manufactured in this State in 1906 was produced at 14 plants, and the output amounted to nearly 1,000,000 barrels more than that of 1905. This advance was not sufficient, however, to restore Michigan to third rank in the list of Portland cement producing States, which was the position she held from 1900 to and including 1904. Many of the plants produced cement through the entire season, running on full time. Several closed down during the winter months for repairs; some of the mills were inactive for a short period because of inability to get coal, due to a coal strike. One plant increased its size, and one was reconstructed. The Hecla factory was re-opened in July, and was in active operation through the rest of the year.

Of the remaining companies reporting from this State, four are erecting mills which are in various stages of construction. All of these four plants have heretofore been reported to this Bureau. One of these, it is expected, will be complete and ready for work next season. The other three are apparently not quite so far advanced, no dates for completion being mentioned. One plant which was active for a short time is now idle. Of the five other companies reporting, three state that they are still striving to attain tangible existence, one states that it has not yet sought to do more than organize but may build in a few years, and a third reports that the work of perfecting titles to land and erecting large Portland cement plants in 3 other States, has thus far prevented the erection of a plant in Michigan. One entirely new company is building a plant in the northern part of the State, and expects to be in operation about 1908, with a capacity of 3,000 barrels of Portland cement a day.

Missouri.—In many respects the records of this State for 1905 and 1906 are similar, for in 1906 two plants produced the entire output of Portland cement made in Missouri, and each of these increased its production over that of the preceding year, as in 1905. The plant located just outside of Kansas City was reconstructed to produce an output about three times as large as that originally intended, and it is still undergoing the process of enlargement. The mills of the Louisiana plant are not yet put up and the organizers are unable to give any indication as to when they will be erected or become active. A new plant at Courtney, about 10 miles east of Kansas City, on the main line of the Atchison, Topeka and Santa Fe Railway, will probably be put into active operation within a year. Seven kilns, 125 feet long by 8 feet in diameter, will be installed, with a minimum capacity of 2,500 barrels of Portland cement a day. The company will also install machinery of capacity sufficient to grind a week's or ten days' supply of raw material ahead, and the same provision will be made at the finishing end of the process. The continued yearly increase in production of the factory at Hannibal is notable. This year it fell only about 25,000 barrels below 1,000,000 barrels more than the output for 1905. Another new plant is being erected at a place about 4 miles west of Carondelet, a suburb of St. Louis, by a company that is now engaged in the manufacture of cement in one

of the Eastern States. The plant is located on a tract of land covering about 150 acres, which is traversed by Gravois Creek. A well-known brick company of St. Louis has been making brick and quarrying stone on this property for years, and has stripped off quantities of clay, and opened a quarry face of large extent, thus making cement materials readily available. The rock is all above the level of the mills, and the materials will be moved to the factory by gravity. The plant will start with six rotary kilns, each 110 feet in length by 8 feet in diameter, and will have a daily producing capacity of 3,000 barrels. The power will be electrical.

New Jersey.—In 1906 New Jersey maintained the rank she has so long held, the second in the list of Portland cement producing States in this country. There were no additional cement plants opened, though projected factories were reported. The output was made, as heretofore, by the three large plants which have been manufacturing New Jersey's Portland cement for several years. The output of two of these factories was larger than in 1905, while that of the third ran far ahead of its previous production. The combined increase shows figures that are more than 750,000 barrels in advance of those for 1905. All the mills were in operation throughout the entire year.

New York.—The record of New York for 1906, so far as its production of Portland cement is concerned, practically duplicates its record for 1905. Nine plants were in operation, and nearly all of them manufactured a larger quantity than during the preceding year. One of the plants was shut down for several months in order to undergo extensive enlargement and improvement. Of the others, some ran almost continuously and some were closed down a short time for necessary repairs. One factory that has for years successfully produced Portland cement by burning it in the old-style dome or vertical kiln, changed its method of manufacture to the newer kiln, and installed large size rotaries, the result of the change being an increased production. Some of the plants increased their output over that of the preceding year; some of them decreased it slightly. One mill which has for many years reported a production of both Portland and natural cement, in 1906, for the first time, made only Portland cement. No new Portland cement factories are reported from this State in 1906.

Ohio.—The cement industry has

grown and is growing in Ohio. All three of the varieties reported in this pamphlet are produced in this State, but the chief cement produced is Portland. Eight plants were active in 1906, and two new factories, designed to produce Portland cement in large quantities, were nearing completion at the close of the year. Seven of the eight active mills ran a few thousand barrels ahead of their production for 1905, and the eighth mill ran about 1,200 barrels behind. The variation from the record of 1905 was not marked, either one way or the other, in any plant, and the State total showed only a small increase over that reported in 1905. At one of the plants a fire caused a shut down for about forty days. At another mill production was suspended for about three months in order to make extensive improvements. The other plants ran on full time except for a few weeks when necessary repairs were being made.

One of the new plants is located at Portsmouth, and will be started up in the summer or fall of 1907, with a capacity of 1,500 barrels of cement a day. The kilns are 100 feet in length, and the plant is so arranged as to allow an immediate increase in capacity of 500 to 1,000 barrels a day. The other new plant is at Center Furnace, in Lawrence County, and will be put into operation during the summer of 1907. It is built with a capacity of 2,000 barrels a day and has four kilns installed, each 125 feet in length. At both plants the materials used will be limestone and shale. Of the eight active factories, five use limestone and three use marl.

Pennsylvania.—From 1890, when with six plants Pennsylvania produced less than 250,000 barrels of Portland cement, to 1906, when with nineteen active plants its record of

production exceeds 18,500,000 barrels, this State has stood at the head of the Portland cement producing States in this country. It has inexhaustible deposits of limestone and cement rock—the materials most commonly used in the manufacture of Portland cement in this locality—and its production has this year gone ahead of that of any other States by more than 14,000,000 barrels. There were nineteen plants engaged in the manufacture of this output, of which fifteen produced exclusively Portland cement, and the remaining four produced both Portland and natural cement. A mill owned by one of the larger companies in the State was damaged by fire, and its output was lessened by the lack of production during repairs. In another mill owned by the same company extensive alterations caused a shut down of several months. The company is now building another large and well-equipped plant at Fogelsville, which will be in active operation next year. Two companies suffered losses by fire and three others were idle for a part of the year because of alterations and improvements made in their plants. The majority of the mills ran steadily throughout the year with only the delays caused by necessary repairs. Satisfactory initial productions were made by the new mills that started in 1906, and five plants now under construction will be producing before or during 1908 if their present plans are carried out. One of these factories is being built at Nazareth by the Atlantic Portland Cement Company; another is the new factory to be erected by the Crescent Portland Cement Company at Wampum, which will be finished as soon as possible. The third plant is to be located at Chestnut Hill, in Monroe County, and will be built

IMPORTS OF CEMENT INTO THE UNITED STATES.

WHERE FROM	AUGUST				ELEVEN MONTHS ENDING AUGUST			
	1906		1907		1906		1907	
	Quantity in lbs.	Value in Dollars.	Quantity in lbs.	Value in Dollars.	Quantity in lbs.	Value in Dollars.	Quantity in lbs.	Value in Dollars.
United Kingdom	35,714,296	\$101,685	12,482,800	\$ 42,796	67,411,896	\$193,371	145,254,016	\$ 500,798
Belgium	48,889,182	202,529	22,846,889	74,701	112,910,244	400,329	191,561,585	567,620
France	892,800	3,057	612,126	7,111	7,873,416	27,436	8,305,426	35,104
Germany	28,597,660	96,810	18,974,986	55,075	145,000,633	488,439	206,817,890	661,443
All Other Europe	280,000	802	2,500	20	288,332	824	950,263	2,129
British North Am.	225,400	1,624	139,650	877	2,455,320	16,918	284,650	1,779
Other Countries	11,887,202	58,980	600,000	3,375	53,274,818	243,589	4,838,218	25,884
TOTAL	126,486,540	465,487	55,658,951	183,955	389,214,659	1,370,906	557,992,048	1,794,757
Domestic Exports of Cement, bbls.	69,210	124,663	110,630	174,936	397,695	631,258	595,816	984,022

There were 7,246,416 lbs. of imported Roman and Portland Cement, etc., in the United States bonded warehouses in Aug., 1906, valued at \$21,383, against 12,454,248 lbs. in Aug., 1907, valued at \$36,274.

For eight months ending in Aug., 1906, there were 64,413 tons of asphalt imported in the United States, valued at \$266,718, against 77,847 tons imported in eight months ending Aug., 1907, valued at \$332,681.

by the Monroe Portland Cement Company. Its minimum capacity will be 1,000 barrels of cement a day, and the company now proposes to manufacture, in addition to Portland cement of the usual high grade made in this State, a pure white Portland of the same quality as any first-class Portland cement. This, it is specifically stated, is an entirely new product. The fourth new plant is that now being built by the Universal Portland Cement Company at Universal near North Bessemer. This factory will use the slag from the Carnegie Steel Company's furnaces at the Homestead works, whence also electric power will be transmitted to the plant. The rotary kilns will be 120 feet long by 7 feet 6 inches in diameter. All the buildings, including the bins for raw material, the dryer building, raw material mill, burner building, finishing mill, stock houses, and miscellaneous buildings—such as the office, laboratory, and machine shop—are being built entirely of steel and concrete. The cement made by this company goes through all the processes required for producing a true Portland cement, and the finished product meets all the requirements for such an article. It should not be confused with slag cement, which is not burned in rotary kilns and is not at all the same as Portland cement.

The fifth new enterprise reported from this State is the plant now under construction by the Conestoga Portland Cement Company in Lancaster County, about 7 miles from Lancaster, on the Conestoga and Cocalico rivers. The beginning of the building operations was somewhat delayed by the fact that the company was compelled to wait for a line to be constructed by the Lancaster and Northern Railway giving connection with the Pennsylvania and the Reading railroads. The factory will have a daily capacity of 2,000 barrels of Portland cement, and will be started with four kilns 100 feet in length by 8 feet in diameter; the buildings are to be so arranged as to leave space for additional kilns and machinery which will increase the output to 3,000 barrels a day. The company expects to be operating late in the spring or early in the summer of 1908.

One company which has reported a production for several years past was adjudged bankrupt and has sold its plant and holdings to a new company, which will continue the business under a new name in 1907. The present year was given to remodeling and repairing the plant.

In this State four factories were reported as idle during 1906.

South Dakota.—The plant which produced the Portland cement output of this State in 1906 continues to be the only cement mill in South Dakota. Since it has been rebuilt its production has been considerably greater than in 1905, although the output for that year was more than four times as large as any ever before reported from this mill. The factory was in operation throughout the year.

The erection of a second plant has been postponed for a time by the promoters, who last year reported that the project was well under way.

Tennessee.—This State, which has not figured in the reports of this office on the production of cement since 1890, is about to become again a producer of Portland cement. Late in 1906 the erection of a plant was begun by a company having large interests in cement production in Kansas, and it expects to begin operating the new plant within a year from the time building was commenced. There will be ten rotary kilns installed, each 110 feet in length by 8 feet in diameter, with about 4,000 horsepower of steam engines and boilers. In the vicinity of the plant, which is located near Copenhagen, there is an abundance of coal, and this will be the fuel used.

Texas.—In 1906 two plants in Texas were producing Portland cement. One of these manufactures a well-known brand of natural cement, as well as Portland, while the other is engaged exclusively in making Portland cement. The first plant reported a production of Portland cement which was very slightly less than its output for the preceding year; the second plant reported a large output, nearly double that for 1905, and many times greater than the Portland production of the other factory. This is only the second output reported from this plant since it was remodeled. It ran on full time throughout the year, and had only a few thousand barrels of cement in stock when the year closed.

Utah.—The construction of the new Portland cement plant near Ogden, in Utah, was slower than the company expected, and therefore its first production will be reported for 1907 instead of 1906. The mills will be completed late in the spring and will be active the rest of the year. The one plant in Utah which has been a steady producer of Portland cement since 1891, when its first output was reported by this Bureau,

is located in Salt Lake City. Its production in 1906 was greater than that for the preceding year. This record is the usual one, however, as the production of this plant has steadily increased for a number of years. Except for a few weeks during which the mills underwent the regular annual overhauling, this factory was continuously active during the year. The company formed in 1905 to build a second plant in or near Salt Lake City was dissolved and the project was abandoned in 1906.

Virginia.—In Virginia there is only one Portland cement producing plant, and that one is entirely successful. Its customary yearly increase in production was marked in 1906, and the mills were active throughout the entire year, except on several holidays. The company is now installing three additional kilns, 125 feet long, and the grinding machinery necessary to keep them active. When the alterations are completed, the factory will be capable of producing 1,000,000 barrels of Portland cement a year. The plant projected in this State by a cement company now active in Pennsylvania has not yet been carried far enough to permit building operations.

Washington.—The new plant built in 1905 and 1906 in Washington is now ready for use, but was not in operation last year. It is very favorably located, and the town that has grown from it is called Concrete. This is the first factory erected in the extreme Northwest, and its initial production will be of interest. Its nearest neighboring cement plants are in North Dakota, Utah, and California, to reach which, from Washington, either Montana, Idaho, or Oregon must be crossed.

West Virginia.—At the only active Portland cement mill in West Virginia in 1906 the reported production decreased by reason of idleness during the installation of new machinery and additional kilns to increase capacity. The enlarged factory will have an output for next year much in advance of that for previous years, if nothing unforeseen occurs. Two other plants which were located in this State have been discontinued. One has failed to produce any cement for several years, and the other was never wholly completed.

Wisconsin.—This state has long been a producer of natural cement, but until now has never had a plant for producing Portland cement. At present, however, such a plant is under construction near Baileys

Harbor, in Door County. The material used will be marl of very high grade. This plant will have a capacity at the start of 2,000 barrels of cement a day. The increase of the plant's capacity depends on the success of the venture.

Natural Cement.

The natural cement industry in 1906 declined in production as compared with the output of the preceding year. This industry fluctuated between a production of 7,000,000 and 8,000,000 barrels from 1900 to 1904, when it fell to a little more than 4,500,000. In 1905 it decreased to a little less than 4,500,000 and in 1906 it stood at just above the 4,000,000 mark.

It seems unlikely that this form of cement making will ever revive to a very marked extent, because, although there will always be work for which natural cement can be used with perfectly satisfactory results, there are many kinds of work for which it is unsuited. Besides that, the result of the process of making natural cement is always uncertain, depending on chance to a great degree, while the result of making cement in rotary kilns, with the machinery which produces a scientific mixture of ingredients that varies only between well-defined limits, is nearly certain.

A number of natural-cement companies have changed their mills entirely, installing rotary kilns preparatory to Portland production; a few have added Portland mills to their natural cement mills, and several plants that formerly produced both kinds of cement have abandoned, at least for the present, the production of the natural variety and in 1906 produced Portland cement only. A large number of plants which for years made big records as producers of natural cement, during the year even stood idle in the States where this industry has been most flourishing.

Production.

The total production of natural cement in the United States in 1906 amounted to 4,055,797 barrels, and had a value of \$2,423,170. This quantity is less than 500,000 barrels below the production for the preceding year, but it shows a larger falling off than was then shown. However, although the quantity of natural cement produced was so much smaller than the quantity of Portland, yet the reports from the factories from various parts of the country seem to indicate that the percentage of natural cement left in the bins unsold at the close of the year was less, proportionately,

than that which remained unsold of the Portland output.

The following table shows the quantity and the value of the natural cement made in the United States in 1904, 1905, and 1906:

Production, in barrels, of natural cement in 1904, 1905, and 1906, by States.

State.	1904.			1905.			1906.		
	Number of works.	Quantity.	Value.	Number of works.	Quantity.	Value.	Number of works.	Quantity.	Value.
Georgia.....	2	66,500	\$37,750	3	89,167	\$51,040	3	^a 180,500	\$98,075
Illinois.....	3	360,308	113,000	3	368,645	116,549	3	365,843	118,221
Indiana.....	13	735,906	367,953	12	527,600	211,040	12	600,000	240,000
Kansas.....	2	210,922	79,456	2	230,686	110,750	2	238,311	129,781
Kentucky.....	2	264,104	132,052	2	207,600	83,000	2	170,194	95,539
Maryland.....	4	65,000	32,500	4	55,324	28,694	4	^a 63,350	32,675
Minnesota.....	2	138,000	65,620	2	115,314	57,643	2	.....	.....
Nebraska.....	1	.....	.....	1	.....	.....	1	.....	.....
New York.....	19	1,911,402	1,138,667	16	1,926,837	1,332,809	16	^a 1,515,866	1,055,785
North Dakota..	1	.....	.....	1	.....	.....	1	.....	.....
Ohio.....	1	.....	.....	1	64,791	51,235	1	.....	.....
Pennsylvania..	5	770,897	298,533	5	748,057	306,555	4	744,403	560,534
Texas.....	1	.....	.....	1	.....	.....	1	.....	.....
Virginia.....	2	93,292	59,619	2	.....	.....	1	.....	.....
West Virginia..	1	.....	.....	1	.....	.....	0	.....	.....
Wisconsin.....	2	250,000	125,000	2	139,128	63,737	2	177,330	92,560
Total.....	61	4,866,331	2,450,150	58	4,473,049	2,413,052	55	4,055,797	2,423,170

^a As shown by the returns to this office, a small quantity of hydraulic lime was produced in Georgia, Maryland, and New York. The combined output of these States is 40,800 barrels, valued at \$19,300, and is included in the total of natural cement production for 1906.

^b The States combined for 1904 and 1905 are noted in the text of the reports for those years.

^c The States wherein the cement product was combined with that of some other State for 1906 are given in the text below.

The combinations of figures for total State productions necessary to conceal individual outputs in 1906 are as follows:

Wisconsin, North Dakota and Minnesota are grouped together; Kentucky, Ohio, and Virginia form a second group; and Texas and Kansas complete the combinations. As is the custom, the State making the largest contribution to the total in these groups carries the entire quantity.

New York ranks first, as always, in this production, with Pennsylvania second, and Indiana third.

The Natural-Cement Industry by States.

The following statement includes only States which have plants that actually manufactured natural cement in 1906, or which have plants that are reported as likely to become active at any time. In a number of States that have for years reported productions of this oldest of all cements, only idle plants now exist; and in several States, as in Florida, the works are completely dismantled. Thus the States recorded do not include all those in which abundant materials for this and other varieties of cement may be or have been found.

Georgia.—There were three plants producing natural cement in Georgia in 1906, and they all had a prosperous year. Two of them were closed long enough to install new machinery and to make necessary repairs. Practically the entire output of these plants was sold, so that but a small number of barrels were left on hand at the close of

the year, though they all ran ahead of their productions for 1905. No new plants were reported for 1906.

Illinois.—In Illinois there are three natural-cement plants, and all of them were active in 1906. Of

the two older plants, one was a continuous producer throughout the year, but its production was not so large as that for 1905; and the other, though idle a part of the time because of a scarcity of labor, still ran slightly ahead of its 1905 output. The third plant produced more cement than was made in 1905. It was closed down three months for repairs, and had some of its stock left in the bins at the close of 1906.

Indiana.—The condition of the cement industry in Indiana remains practically the same as it was in 1905. Most of the mills in what is known as the Louisville district, which for many years was one of the great centers of production for natural cement, now find it more profitable to remain inactive and allow their "quota" to be burned and ground in one of the big mills, and handled by the general selling agent for the various companies, than to make and sell their product as individuals. There are, however, several mills besides those which made cement for the idle plants that were active in 1906, but none of them ran for more than a few months. The prospect of converting a number of these factories into Portland-cement plants is being seriously considered in this region. The quantity of natural cement manufactured in this State was slightly above that produced during 1905. The sale of the output was readier and less of it remained in stock at the end of the year than in 1905.

Kansas.—The natural cement industry in Kansas is much older than the manufacture of Portland

cement, and the two plants that produced natural cement in 1906 ran ahead of the output for 1905, though the increase was but slight. One plant was closed down for a few weeks in order to dispose of the stock on hand and avoid over production; and the other ran continuously. In each only a small percentage of the output was left on hand at the close of the year. One of these companies is contemplating the enlargement of the factory to produce Portland as well as natural cement, as an abundance of suitable material for such a production is available, but no final steps have yet been taken in the matter.

Kentucky.—The two mills in Kentucky which make natural cement were active in 1906. They are situated on a ledge of rock on the Kentucky side of the Ohio river, and are owned by the same company. Their output during 1906 was not quite equal to that of 1905. They ran continuously throughout the year.

Maryland.—Only two natural cement mills were active in Maryland in 1906. Two others were idle, one of them reporting that it has closed down permanently. The other was idle because there was no demand for natural cement which it could supply. The active mills produced small outputs, and neither of them ran continuously throughout the year. One of the four companies in Maryland has under consideration the erection of a mill to produce Portland cement, but the plant, if built, will be located in a neighboring State.

Minnesota.—Owing to a lack of plants in neighboring States, the production of natural cement in Minnesota has continued to be profitable, even after the industry waned in other localities, but in 1906 there was but a small production in the State, and a lack of trade is reported. Both of the two plants were active, and their production ran a few thousand barrels in advance of that for 1905. Each of the mills was idle for a short period in the winter months, partly because of the severe weather and partly because the demand was not good.

Nebraska.—The plan to start up the single cement factory in Nebraska and make natural cement in 1906 was not carried out and the plant was idle through the year, because there was no demand for natural cement in this State.

New York.—The natural cement output for the State of New York was made by nine plants in 1906, this fact showing very clearly the extent to which this branch of the

cement industry has declined in the Rosendale district, which was for many years to the natural cement production what Pennsylvania now is to the Portland output. Nearly every one of the nine active plants produced less cement than in 1905. One company was overhauling its mills throughout nearly the whole season; a number of the plants were idle during the winter months; another company reports that a shut down of one-third of the usual time of activity was due to lack of orders; still another reports several months' idleness for the same reason. The companies that were active ran their plants on about half time for at least a portion of the season. Six companies report that their factories were closed down throughout the year, and one company which in former years invariably recorded a large production reports that the plant has practically ceased to make cement and has turned to the manufacture of lime and other similar products.

North Dakota.—The single cement plant in North Dakota reported a small production in 1906, being idle part of the season on account of the scarcity of labor. No cement is produced here through the winter months, because of the severity of the weather.

Ohio.—Two natural cement plants were idle and one was active in Ohio in 1906. One of these plants is idle because the owner does not desire to run his factory, neither does he wish to sell. The other plant stood idle through the year because of the small profit to be had by running the factory. The third plant was active through the entire year, except a short time for necessary repairs, made a fine production, and sold it all, closing the year with empty storage bins.

Pennsylvania.—In Pennsylvania there were no plants devoted exclusively to the production of natural cement in 1906. The entire quantity produced there was made by plants that were also engaged in manufacturing Portland cement, and at all of these the production of Portland was much larger than that of natural rock cement. These plants, four in number, produced an output smaller than that of the preceding year by only a few thousand barrels. They were all active continuously except where it was necessary to close down a few weeks for repairs, and the product was almost completely disposed of when the year closed. One plant that had a suitable equipment for the production of natural cement remained idle all the year, so far as

that part of the plant was concerned. No new natural cement plants are reported.

Texas.—The natural cement made in Texas in 1906 was manufactured by a plant which also had a production of Portland cement. In 1906 its production of natural cement ran ahead of that for 1905, though such was not the case with its other output. The remaining factory for producing natural rock cement was idle throughout the year. It has not been active for several years, and it is doubtful if it will ever be fired again as it now stands.

Virginia.—In 1906 the natural cement industry in Virginia was not very prosperous, though the output of its one active plant was but little less than double its output in 1905. The plant was idle during some bad winter weather, and also by reason of the limited demand for this variety of cement. However, at the close of the year, only a small portion of the product was unsold. The other plant which was active in the early part of last year, became idle late in 1905 and remained so through 1906. It is reported that this factory has permanently abandoned the natural cement industry. The total production of the State in 1906 was somewhat in excess of that for 1905.

West Virginia.—Neither of the plants in West Virginia which have in the past produced natural cement was active in 1906. One seems to have been abandoned completely and the other is reported to be involved in litigation.

Wisconsin.—Two natural cement plants have been active in Wisconsin for many years until 1906, when one of them was idle continuously by reason of the lack of demand for this variety of cement. This plant may be offered for sale to a company projecting the erection of a factory to produce Portland cement. The other mill was active during the greater part of the year and made a large quantity of cement. This production, however, fell short of that for 1905 by a few thousand barrels. It was sold before the close of the year, but the failing demand for this variety of cement was apparently in Wisconsin as in other States.

PUZZOLAN CEMENT.

The slag cement industry continues to be of slow growth, for in 1906 only one plant for making puzzolan or slag cement was finished and started to work. It is located in New York State. This is the first time this variety of cement has

been made in New York. An advantage of the slag-cement industry lies in the fact that it utilizes and consumes a product of steel and iron foundries which has for years been troublesome to dispose of and regarded as a waste product. The variety of cement known as puzzolan, or simply as slag cement, is not burned in rotary kilns, and should not be confused with Portland cement made with slag as a basis and burned in rotaries.

Production.

Although eight States were engaged in producing the 481,224 barrels of puzzolan cement, which made the total production in 1906, yet it is impossible to place the individual output against each State in the table, because six of the eight States have only one slag-cement plant. The other two States have each two plants, and so, in combination with another State production, their figures may be given without revealing individual figures.

The combinations made in the following table are: Two plants in Alabama, one in Kentucky, and one in Illinois, two plants in Ohio and one in Pennsylvania, and one plant each in Maryland, New Jersey, and New York.

The following table shows the total production of puzzolan or slag cement in the United States in 1904, 1905, and 1906, together with the number of plants in each State:

them is owned by that company. The people owning the second plant have leased it for the past few years to the company now running both plants. No idleness is reported in these mills, beyond the closing down for needed repairs, which comes to nearly all factories. Better prices, as well as an increased production, was the rule for these plants in 1906.

Illinois.—But one plant in Illinois manufactures slag cement, and its output in 1906 was considerably larger than that for the preceding year, as in that year, however, the entire quantity of puzzolan cement manufactured was consumed by the company itself in its construction work. Slag cement for commercial purposes is no longer made by this plant, and its whole period of manufacture for the year did not exceed five months.

Kentucky.—The single plant in Kentucky which produced slag cement in 1906 was started up in 1905; it was described in the report on cement for that year. This year the company reported a good production. Kentucky now contributes her quota to each of the three varieties of cement reported by this Bureau.

Maryland.—There has never been more than one puzzolan cement plant in Maryland, and in 1906 it was active for only a short time, producing but a small output. It was then ad-

except for the three winter months. Its output was a little less in quantity than that for the previous year, but a higher price was obtained for it than could be had in 1905.

New York.—The plant of the Niagara Cement Company, in New York began producing puzzolan cement in the spring of 1906, and ran continuously during the rest of the year, except for such small shut-down periods as are incidental to initial runs. This factory is in Buffalo, and has a capacity of 1,000 barrels of slag cement a day. It is the first plant built in the State of New York for producing this variety of cement.

Ohio.—There were two plants for the manufacture of puzzolan cement in Ohio in 1906. Both of them were in operation, one running slightly ahead and one slightly behind the production for 1905. Each of these plants was shut down for a few months, and in one of them extensive improvements were made. Although one other State besides Ohio has two puzzolan plants, yet Ohio in 1906 produced more than twice as much of this kind of cement as any other State, and more than the combined produce of any two other States.

Pennsylvania.—The plant which produces puzzolan cement in Pennsylvania is at Sharon, and its production in 1906 was more than a third larger than in 1905. It was idle during a part of the winter on account of the dullness of business incident to that season.

Production, in barrels, of slag cement in the United States in 1904-1906, by States.

State.	1904.			1905.			1906.		
	Number of works.	Quantity.	Value.	Number of works.	Quantity.	Value.	Number of works.	Quantity.	Value.
Alabama	2	187,677	\$141,402	2	.....	.....	2	.....	.....
Illinois	1	.....	.....	1	106,236	\$80,616	1	175,942	\$168,160
Kentucky .....	.....	.....	.....	1	.....	.....	1	.....	.....
Maryland	1	.....	.....	1	.....	.....	1	.....	.....
New Jersey	1	.....	.....	1	.....	.....	1	54,161	60,478
New York .....	.....	.....	.....	.....	.....	.....	1	.....	.....
Ohio	2	115,368	85,249	2	276,211	191,998	2	251,121	184,283
Pennsylvania ..	1	.....	.....	1	.....	.....	1	.....	.....
Total	8	303,045	226,651	9	382,447	272,614	10	481,224	412,921

The Puzzolan Cement Industry by States.

The record of slag-cement producing plants in the States which contributed to the quantity of this variety of cement made in the United States in 1906 is as follows:

Alabama.—There were two active puzzolan-cement plants in Alabama in 1906, and together they produced an output which was nearly twice as large as that for 1905. These plants are managed and run by one company, though but one of

judged bankrupt, and a trustee was appointed.

New Jersey.—The one slag-cement plant in New Jersey was active in 1906 and ran continuously

Imports, in barrels, of hydraulic cements into the United States in 1903-1906, by countries.

	1903.	1904.	1905.	1906.
United Kingdom	146,994	16,265	33,978	464,940
Belgium	737,576	394,368	335,154	563,590
France	14,866	34,912	18,864	64,227
Germany	1,377,414	585,563	456,325	871,579
Other European countries	27,415	7,538	602	49,770
British North America	4,421	566	417	9,589
Other countries	9,265	7,091	1,237	182,015
Total	2,317,951	1,046,403	846,577	2,205,710

IMPORTS AND EXPORTS.

Imports.

Hydraulic cement is recorded in the custom-houses in pounds when brought into this country from foreign places. Reduced to barrels, the total quantity imported in 1906 was 2,205,710, valued at \$2,950,268. The total quantity withdrawn for consumption in 1906 was 2,274,677 barrels.

The following table shows imports of all hydraulic cements into the United States, by countries, from 1903 to 1906:

Relation of Domestic Production and Consumption to Imports.

The following table is designed to show the yearly increase in the production of Portland cement in the United States, the fluctuations in natural cement, and the variations in imports for consumption of hydraulic cements into this country since 1901:

Comparison of production of Portland and natural-rock cement, in barrels, in the United States with imports for consumption of hydraulic cement, 1901-1906.

Year.	Natural cement.	Portland cement.	Total of natural and Portland cement.	Imports.
1901.....	7,084,823	12,711,225	19,796,048	922,426
1902.....	8,044,305	17,230,644	25,274,949	1,963,023
1903.....	7,030,271	22,342,973	29,373,244	2,251,969
1904.....	4,866,331	26,605,881	31,372,212	968,410
1905.....	4,473,049	35,246,812	39,719,861	896,845
1906.....	4,055,797	46,463,424	50,519,221	2,274,677

The puzzolan cement production, which is not included in this table, and which has been recorded in these reports only since 1901, is as follows: 1901, 272,689 barrels; 1902, 478,555 barrels; 1903, 525,896 barrels; 1904, 303,045 barrels; 1905, 382,447 barrels; 1906, 481,224 barrels.

In the following table it is impossible to make comparison between domestic Portland cement and imported Portland cement, for the reason that the figures showing the imports or exports of cement to or from this country are not divided into classes, such as Portland, natural, or puzzolan cements, but are received at the Bureau of Statistics grouped under the general head of "hydraulic cements." Hence the table shows a comparative statement of the production of Portland cement in the United States with the entire quantity of hydraulic cement imported into and consumed in the United States, in 1891, 1904, 1905, and 1906.

Comparison of domestic production of Portland cement with consumption of Portland and all imported hydraulic cements, 1891, 1904, 1905, and 1906, in barrels.

	1891.	1904.	1905.	1906.
Production of Portland in the United States.....	454,813	26,505,881	35,246,812	46,463,424
Imports (entered for consumption).....	2,988,313	968,409	896,845	2,274,677
Total.....	3,443,126	27,474,290	36,143,657	48,738,101
Exports (domestic).....		774,940	897,686	583,299
Consumption.....	3,443,126	26,699,350	35,245,971	48,154,802
Percentage of production of Portland to consumption in the United States.....	13.2	99.2	100	96.49

The apparent decrease in the percentage of production to consumption in the United States in 1906 is explained by the fact that notwithstanding the greatly increased output of Portland cement, the demand exceeded the supply. On the wes-

tern coast this deficit was most sharply felt, but it was a factor in nearly every State in the Union in 1906, and in many places during the early part of the year building operations involving the use of large quantities of cement had to be suspended pending the arrival of that material from some other than the local market.

The result of this shortage was an unusual and pronounced increase in the quantity of cement sent to this country from abroad during the latter portion of 1906.

This increase is very clearly shown in the figures sent to this Bureau by the Bureau of Statistics.

Exports.

The fact that in 1906 the quantity of cement exported from this country amounted to but little more than 500,000 barrels, or but a trifle over half as much as was exported during the preceding year, marks the fact already stated, namely, that the supply of cement in the United States in 1906 was not equal to the demand.

The total quantity of hydraulic cement exported from the United States in 1906 was 583,299 barrels, valued at \$944,886; decidedly less than the quantity exported in 1904 or 1905.

The following table shows ex-

The following table shows the apparent total consumption in the United States of all hydraulic cements in 1906:

Total consumption of hydraulic cements in 1906, in barrels.	
Total production in United States	51,000,445
Imports withdrawn for consumption	2,274,677
Total	53,275,122
Exports	583,299
Total consumption	52,691,823

The importance of cement as an item of export from America is not sufficiently considered in this country, though it receives some attention in the foreign markets.

In 1906 it was impossible to give this matter serious consideration, because of the shortage at home. But, as before suggested, with the rapid increase in the number of cement factories and the possibility of dull years in construction requiring cement, it seems only wise to seek to build up the export trade in American cement before the strain arrives.

The falling off during the last few years of the exports of Portland cements from other countries into the United States is being seriously considered in the foreign markets. Germany, from 1893 to 1896, sent us \$1,261,000 worth of cement, which was almost half of the entire quantity exported, while in 1901 this amount declined to \$616,300. In other words, whereas in the years from 1900 to 1903 the United States took about 38 per cent of Germany's export trade in cement, in 1904 less than 15 per cent was taken. Exports from Great Britain and from Belgium to the United States have experienced a similar decline. In fifteen years the total imports of cement into this country from abroad have been reduced about 66 per cent, and in Great Britain the exports of cement to America have fallen from 50 per cent to 5 per cent of the quantity sent out of that country.

Cement in Foreign Countries.

Canada.—A summary of the mineral production of Canada for 1906, issued in advance of the Annual Report of the Geological Survey of Canada, states that the total quantity of Portland cement made in Canada in 1906 was 2,152,562 barrels, as compared with 1,541,568 barrels in 1905, an increase of 610,994 barrels, or 39.6 per cent. The total sales of Portland cement were

ports of hydraulic cements since 1900:

Exports of hydraulic cement, 1900-1906, in barrels.							
Year.		Quantity.	Value.	Year.		Quantity.	Value.
1900	.....	100,400	\$225,306	1904	.....	774,940	\$1,104,086
1901	.....	373,934	679,296	1905	.....	897,686	1,387,906
1902	.....	340,821	526,471	1906	.....	583,299	944,886
1903	.....	285,463	433,984				

2,119,764 barrels as compared with 1,346,548 barrels in 1905, an increase of 773,216 barrels, or 57.4 per cent.

Fifteen companies were operating plants in Canada during 1906, with a total daily capacity of about 10,500 barrels, viz., one in Nova Scotia, two in Quebec, eleven in Ontario, and one in British Columbia. At least four plants were under construction during the year, of which the total initial daily capacity will be about 4,700 barrels.

Detailed statistics of production in 1905 and 1906 are as follows:

Production, in barrels, and value of cement in Canada in 1905 and 1906.

	Portland cement.		Value of
	Manufac- tured.	Sold.	cement sold
1905	1,541,568	1,346,548	\$1,913,740
1906	2,152,562	2,119,764	3,164,807

The average price per barrel at the works in 1906 was \$1.49 as compared with \$1.42 in 1905.

The imports of Portland cement into Canada in 1906 were 694,503 barrels, valued at \$778,706, an average of \$1.12 per barrel. The duty is 12 1-2 cents per hundred pounds, and the barrels of cement are reckoned at 350 pounds each.

Very little cement is exported from Canada, so that the consumption is practically represented by the Canadian sales and the imports. The total consumption of Portland cement in Canada for the past six years is as follows:

Portland cement consumed in Canada, 1901-1906, in barrels.

1901	872,966
1902	1,139,548
1903	1,401,419
1904	1,694,988
1905	2,264,106
1906	2,814,267

The quantity of natural cement marketed in 1906 was 8,610 barrels, valued at \$6,052. The decrease in the value of natural-rock cement in 1906 as compared with 1905 was \$4,222. The increase in the value of Portland cement for that period was \$1,251,067, or 58.86 per cent in quantity and 65.37 per cent increase in value. This increase in quantity and value of Portland cement is taken from a table prepared to show the mineral products which have had the greatest growth in output in 1906, and in the text preceding this table Portland cement is mentioned as showing a greater growth than any other product during that year. The relative importance of Portland cement in the various industries contributing to the total mineral output of Canada is shown by the fact that it contributed 2.75 per cent in 1905 and 3.96 per cent in 1906.

Germany.—The cement industry in Germany was very profitable in 1906 in comparison with its condition for the last four or five years. Eight years ago companies engaged in the manufacture of cement in Germany were paying 14 per cent dividends. Four years ago these dividends had fallen to 4½ per cent. In 1906 they rose to 11 per cent again.

This increase was due, first, to the building activity throughout the country; second, to steadiness in prices; and third, to the increase in exports of cement to the United States by reason of the demand for cement on the western coast. The San Francisco and the Valparaiso earthquakes were important factors in creating a foreign market for German cements.

There are in all 320 cement mills in Germany, of which 117 manufacture Portland cement. In 1906 a number of new mills were put into operation, though the business is already overcrowded, and the margin of profit very small. In Berlin cement is often sold at a profit of only 50 pfennigs (11.9 cents) per barrel to the manufacturer. In 1906 prices in that city averaged about \$1.35 per barrel of 170 kilograms or 375 pounds, including packing.

Germany has pushed her export trade into far-off markets, and now has direct communication with many of them in steamers flying her own flag. British and Dutch South Africa, Portuguese East Africa, British Molucca, Dutch India, China, France, Norway, Sweden, Russia, Mexico and both coasts of South America, British India, Hongkong, Kamerun, Australia, and the Philippines are all countries where in German cement is marketed.

Any attempt on the part of the United States to compete in these markets should be made with a distinct knowledge of the excellent quality of the German product. Inferior cements, or badly packed barrels carrying superior cement, can not successfully compete with them. A letter from the American consul at Port Limon, in answer to the inquiry of an American cement company regarding shipments of cement to Costa Rica, says:

"The only reason why German and Belgian cements are preferred to the American article is the way they protect theirs, by using an iron drum instead of a wooden barrel, for all shipments to this coast. The reason for this is the climate. During a great part of the year it is so moist that clothing hung for a week in a wardrobe will mildew. Barrels of cement sometimes be-

come broken and often have to stand on open cars or an uncovered dock for days. The cement becomes moist, hardens, and is worthless. Our largest importers claim that their sole reason for buying German instead of American cement is that the former stands the climate better, and not that it is cheaper; they prefer the American article."

The combination between German and Belgian cement makers made late in 1905 is framed in terms to include the French and English cement trade in Holland in its regulations. The general syndicate which now includes the whole German territory has succeeded in strengthening, to some extent, the confidence of the manufacturers in the maintenance of fair prices. This agreement of the cement association has, however, excluded the middlemen, in consequence of which there is much complaint, so that the union of German dealers in building materials, including 700 firms, which handle 1,300,000 tons of cement annually, planned a buying syndicate and demanded an extra rebate of from 6 to 10 per cent from manufacturers for its members. This being refused, further conflict threatens the cement industry in Germany, and the union dealers are discussing the erection of their own factories.

Holland.—In the Netherlands there is only one very small cement mill, which produces not more than 2,000 tons (11,200 barrels) a year, and therefore plays but a small part in the cement trade of the Netherlands. The official statistics of the Government do not specify the quantity of cement annually imported into the Netherlands, but its use in concrete construction as applied to bridges, buildings, and tunnels is increasing from year to year.

Cement sells in Holland at about \$1.45 per barrel, and the bags in which it is packed, if returned, are credited to the purchaser at 5 cents each. A reduction of 32 cents per 1,000 kilograms (2,204.6 pounds) is made to buyers of large quantities, and an additional reduction of 8 cents per 1,000 kilograms to those buyers who act in conformity with the rules of the German trust. This makes the actual cost of cement delivered at Rotterdam or Amsterdam about \$5.80 per 1,000 kilograms, or a few cents more than \$1 per barrel.

American cement of good quality could no doubt find a market in the Netherlands, provided the Dutch consumer could be induced to drop connection with the German trust

by a guarantee of lower prices and of a supply in the quantities needed at stipulated times.

England.—The many inquiries for cement to be used in rebuilding San Francisco have led the United States consul at Hull to give the following facts:

About 4,000 tons of limestone are brought to Hull each week, and the production of cement is about 5,000 tons per week. The supply could be increased under pressure. The cost of the barrels is larger than in America and adds materially to the price of the cement. Bags cost 25 cents extra each, but on the return of the empty bag most of this is refunded. Since the San Francisco earthquake the demand for cement has been exceptionally large, and it is difficult to fill orders now, as the supply is running short. The demand for British cement on the Pacific coast for the past five years has been light, and the British consul at San Francisco states that the cement trade there has during recent years been largely captured by Belgium and Germany.

South Africa.—This country has presented, since the British occupation, one of the best markets in the world for cement, because of new activity in the public works department. During the past few years importations of cement have not fallen much short of \$1,000,000, and in 1903 the records show \$2,500,000 worth of cement imported into South Africa. America has had a very minor part in supplying this demand, shipping to the Transvaal less than \$400 worth in 1903, and about double that in 1904, while Germany and England each supplied from \$250,000 to \$500,000 worth of cement in those years.

Before 1898 the United Kingdom furnished the bulk of all cement to Africa; but with the subsidizing of steamship lines, and cheap rates to seaports in Germany, that country began to supply cement and acquired about 16 per cent of the South African trade. In 1902 Belgium and Denmark began to compete, and the list was as follows: United Kingdom, 43.4 per cent; Germany, 37.2 per cent; Belgium, 18 per cent, and the remaining 1.4 per cent was divided between Denmark and other European countries, the United States not competing at all. In 1903 Austria, France, Italy, Holland, and Sweden were competitors, and acquired a part of the trade before held by Germany. Great Britain increased to 51.4 per cent and Germany fell to 23 per cent. From that time the United Kingdom has gradually increased its

trade and advanced from 70 per cent in 1904 to about 90 per cent in 1905. In Great Britain the claim is made that this result is due to the firm and united action of the British manufacturers, to the uniform quality of their product, and to the customs preference, though it is also claimed that the subsidies paid to the steamship lines of the Germans offset this last item.

The one cement factory in South Africa is situated just outside Pretoria, and was a failure up to a year ago, when an American was placed in charge of it. An American kiln was immediately substituted for the one formerly used, and other American ideas were adopted. The result in 1905 was a production of 75,000 barrels of cement, which was marketed in Pretoria at \$6.08 per barrel, and many times that quantity could have been sold in Johannesburg alone. The capacity of this factory is to be trebled, and other mills are being planned for location in the Orange River colony near Johannesburg.

Cement Products Exhibition at the Coliseum, Chicago, Dec. 17 to 21st, 1907. This building encloses the largest exhibition space in the West. For space apply to L. L. Fest, Manager, New Southern Hotel, Chicago.

PREVENTION OF THE COLLAPSE OF BRICK WALLS AT FIRES.

We condense the following from the London Builder's Journal. Firemen and insurance surveyors know from experience of fires that brick buildings almost invariably collapse outwardly, due to the inner face of the wall expanding more than the outer face, forcing the wall outward. Chief Officer Ditman of the Bremen fire brigade, mentions two distinct instances confirming this theory, which occurred during the present year, of walls expanding as above stated, and the method applied to counteract such expansion. The first case was that of a 9-inch external brick stable wall 33 ft. high. This wall after the roof had burned away overhung to such an extent that the streets were cleared of spectators under the momentary expectation that the wall was about to fall into the roadway. Then two spray nozzles were brought into action on the inner face of the wall, and within ten minutes the wall righted itself and again became perpendicular. This wall is now in use. On May 1st in the case of a

very large fire, a brick wall 30 ft. high overhung about 18 inches at the top with a tendency of immediate collapse. When six streams of water were directed near the inner face of this wall with the object of cooling down the temperature between the wall and the burning interior, after which the water was thrown directly upon the inner face of the wall. In fifteen minutes the wall was brought back to perpendicular. This wall is also again in use. A paper on this conflagration was read before the Bremen Architects and Engineers society and a technical paper covering the same subject was read at the Stuttgart meeting of the Association of German Professional fire chiefs.

COMMENT BY THE EDITOR.

The inner face of a concrete wall will not expand to the same extent during a fire, because the water used in mixing the concrete must first be driven off before the cement expands. (This water taken up by the concrete unites with the cement as water of crystallization. Under high temperatures, the water of crystallization is driven off in the form of vapor which cools the surface layer through which it escapes. While the outer face of a concrete block wall may be red hot, just back of the heated surface evaporation is taking place which forms an insulating medium which prevents the heat from penetrating into the block until the water of crystallization has been vaporized; this prevents the block from expanding as in the case of brick walls; because the high temperature is doing work in breaking down or de-hydrating the cement in concrete, which would otherwise develop expansion in the block. In other words the concrete carries its own automatic sprinkled system which will prevent the wall from expanding and consequently collapsing as in the case of a brick wall; because all the water used in mixing the concrete must be expelled before dangerous expansion can take place.

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NEW IDEA IN HARBOR CONSTRUCTION.

Swakopmund, the chief shipping port of Germany, South Africa, is without harbor facilities. The German government built a breakwater at the cost of \$750,000 (M. 3,000,000) upon which cargoes were received and shipped. Vessels can no longer receive or discharge cargoes on account of the harbor being filled by shifting sands. A narrow 24-inch gauge railway, the longest in the world, is now under construction from Swakopmund to a rich copper mining district 361 miles inland. Supplies for this new road have been detained in the open roadstead for months before material could be landed on lighters. The construction of harbor improvements therefore becomes a serious problem. Several plans are now under consideration to remedy existing conditions. The government called in Arthur Koppel and H. Bachstein, both of Berlin, to assist in devising plans for the construction of the new harbor works. These two firms called in Herr Consul Wilhelm Kunstmann of Stettin who had successfully constructed a harbor of refuge on the Swedish coast, using the hulls of old vessels which were sunken, forming a jetty upon which tracks were laid from the shore, which made it possible to load iron ore onto vessels while the sea was running high. In the open roadstead Herr Kunstmann's plans for the mole or combined dock or breakwater at Swakopmund, is to run the mole out into the sea in a slightly bent form, the outer edge to act as a breakwater, while the inner edge opposite the land will offer mooring places for ocean vessels. In order to impart to the mole the requisite degree of stiffness, the foundation will be composed of the sunken hulls of old iron ocean steamers which after engines, boilers, etc., are taken out, will be filled with stone and cement, forming concrete, so that each will constitute a rigid mass weighing perhaps as much as 15,000 tons. On the top of these sunken and filled up hulls which will also be supported on each side by blocks of masonry, a platform will be built and rails laid along it in connection with the land, so that the shipment or discharge of cargoes may be loaded direct from or into the railway trucks.

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FEEDING TREES THROUGH THE TRUNKS.

In recent experiments the artificial feeding of trees through incisions in their trunks has given remarkable results in restoring health and vigor, and in saving valuable specimens whose roots had been so weakened by disease as to draw insufficient nourishment from the soil. The death of many apple trees on the estate of M. Simon, at Allaire, France, was traced to an affection of the rootlets. To treat diseased trees a tube was inserted through the bark of the stem to the layers having the sap vessels, and liquid was supplied from a reservoir placed from three to five feet higher than the hole in the bark. An apple tree in bad condition absorbed a pint and a half of water in twenty-four hours, then two quarts of liquid fertiliser containing fifty grams of sulphate of potash in twelve days, and afterwards dilute fertiliser, including nitrate of potash. The treatment, begun early in March, was followed by vigorous spring growth, and by September new twigs were eight to ten inches long. Other results showed that apparently dying trees might be restored. An attempt to improve cabbages, cauliflowers, and potatoes by the same process, using a half per cent. solution of common salt, gave products of exceptional size and flavor.

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Prospectors from the Southern States Portland Cement company are reported to be investigating a lime rock deposit near Jasper, Marion Co., Tenn. The Dixie Portland Cement Co. just completed, is in the same county, nine miles south of Jasper. Test holes have been made, showing 50 ft. of shale near the lime rock deposits. Both materials have been pronounced first class for Portland cement raw material.

The York Portland Cement Co. of Portsmouth, Ohio, has commenced operations, the Garden City Sand Co., of Chicago are the general sales agents of the company, and are now placing agencies in various parts of the country for the sale of the York Cement company's product.

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MOLASSES AS A FIRE EXTINGUISHER.

It is surprising how few people are acquainted with the real nature and properties of molasses. Even men who have worked in sugar mills and distilleries for years often betray ignorance in this respect. The writer had occasion some time ago to scientifically investigate the properties of molasses, and found it a very difficult problem to burn off a large quantity of surplus molasses without the aid of specially constructed furnaces. Molasses is not the highly inflammable mixture that people imagine it to be. It would be practically impossible to set a tank of molasses on fire by any means whatever. Even a mixture of molasses and methylated spirits or sulphur will burn very imperfectly at first, and finally smolder and die out. A charge of molasses will extinguish or damp down the strongest furnace fire in a few minutes. A jet of molasses played on burning wood will instantly extinguish the fire, and the wood cannot be again fired until the molasses is removed from the surface. For extinguishing large tanks of burning oil, kerosene, or spirit, there is nothing more effective than bags or tarpaulins steeped in molasses, and when such tanks are in danger of being fired they should be covered over and made air-tight with tarpaulins that have previously been immersed in heavy molasses.—Bundaberg Mail (Australia.)

The Oklahoma Gypsum company, of Minneapolis, Minn., and Okeene, \$25,000 capital stock; incorporators, C. F. Haglin, H. N. Leighton and E. G. Potter, of Minneapolis; H. E. Wilson and E. R. Black, of Okeene, Blaine Co., Oklahoma.

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The Santa Fe Railway company is surveying a route from its main line to the site of the Monarch Cement company at Humboldt, Kansas.

Hon. D. Linn Gooch has been looking up a site for a new Portland cement plant to be located near Wellston, Ohio.

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INCORPORATED.

The Thomas Cement Construction Co., of Joliet, Ill.; capital \$100,000, to operate under patents granted to Augustus O. Thomas of Joliet, Ill., for the manufacture of concrete building blocks.

Contract has been let to the Freeborn Engineering and Construction Company of Kansas City, Missouri, by the Hawkeye Portland Cement Company, of Kansas City, Missouri, for the design and construction of their 2,500 bbl. plant to be located at Harvey, Iowa.

Construction work has already commenced, and the plant will be in operation November 1st, 1908. This plant will be fireproof throughout. The cement company has a very desirable proposition, the plant being located directly on three large railway systems; it has its own coal mines on the property and an abundance of very desirable raw materials.

The officers of the company are: F. E. Wear, President; W. E. Murlin, Vice President; H. M. Rubey, Treasurer, and A. L. Murphey, Secretary.

The offices of the company are in the R. A. Long Bldg., Kansas City, Missouri.

The Simeuck Water & Enterprise Co., of Limerick, York Co., Me., has advertised for bids for a concrete dam 20 feet high to be built across the Ossippi River five miles below Limerick and will develop 300 h. p. and will cost \$50,000. The power will be used at the worsted mills at Limerick. Work will commence next spring.

Socon. Marshall Co., Ill., is considering the erection of a new concrete block jail.

Iowa and Alabama capitalists are uniting on a project to erect a cement plant at St. Stephens, Washington Co., Ala., capital \$1,000,000, on the Tombigbee River, about 70 miles above Mobile.

A company, name unknown, is reported to have purchased 40 acres of land at Van Dorn, Marengo county, Ala., a station on the Southern Ry., a few miles east of Demopolis, Ala., upon which a cement plant is to be erected. The local press states that \$1,120,000 has been issued by the company.

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A cement post foundry is to be established at Hutchinson, Kan., H. McDonald of the same place, is one of the projectors.

INCORPORATORS.

Kansas Portland Cement Company; capital stock, \$1,000,000; A. B. Cockerill, Nevada, Mo., president; directors, L. H. Callaway, Nevada, F. J. Horton, Leigh Hunt, A. H. Campbell and G. E. Nicholson all of Iola, Kan.

W. H. Roberts & Joseph Laroche were tried and convicted before Judge Ançon in the City Criminal Court of New Orleans for obtaining two orders of cement on false pretenses from R. Costenadofi, a dealer in that city, both prisoners were given a six months sentence to be served in the Parish prison.

The new plant of the Kansas City Portland Cement Co. at Cement City, Missouri, has now been in operation sixty days producing the guaranteed capacity given by the contractors.

This plant is built entirely of steel and reinforced concrete, and is fireproof throughout. It is an example of the best fireproof construction put in cement plants.

The engineering and construction work of this plant was done by the Freeborn Engineering & Construction Company, Kansas City, Missouri.

Groff-Okey Burial Vault Co., Indianapolis, Ind. Capital stock \$20,000. To manufacture and sell cement burial vaults.—N. B. Groff, G. B. Okey, W. G. Front, are the incorporators.

Crete, Ill., laid 5,725 feet of sidewalk during present season.

The Reiley Cement Block factory at Ritchie, Will County, Ill., 53 miles south east of Chicago is enlarging its factory for the purpose of shipping blocks to Chicago, where the demand has been so great as to extend the supply.

Standard Concrete Stone Co., Elizabeth, N. J., to manufacture cement blocks, artificial stone, brick, etc.; capital, \$25,000. Incorporators: Peter J. Olde, John M. Olde, Louise F. Olde, No. 829 Elizabeth avenue, Elizabeth, N. J.

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The Ajax Portland Cement Company has commenced clearing up its building site near Independence, Kansas, under the supervision of Engineer McKee, representing the Westinghouse, Church Kerr Company the right of way for a switch track is being graded from the siding which now connects the Independence Portland Cement Co.'s plant at Independence with the Santa Fe Ry. and the Missouri Pacific tracks. The contractors are delivering lumber and other building materials at the site by teams. Rough temporary buildings to house the contractors employees are under construction as well as shop and office buildings. The ledge of lime stone rock is being cleaned up; spring water has been piped to the site, 100 men will be employed as soon as the switch track is completed.

The J. R. Alsing Company, founded in 1869 and organized under the laws of the State of New York in 1883, have changed their name to the J. R. Alsing Engineering Company under the laws of the State of New York, and increased their capital stock from \$20,000.00 to \$100,000.00. The officers will be the same as in the old company.

The enormous increase in their business compelled them to make the above change.

WESTERN CEMENT CO. TO BE DISSOLVED.

The Western Cement Co. of Louisville, after an existence of 20 years will be dissolved on Nov. 7. The company controlled about 20 subsidiary concerns and had a practical monopoly of the manufacture of hydraulic cement in Indiana and Kentucky, having an agreement as to price with its only competitors. The announced reason for dissolution is that Portland cement has decreased the demand for hydraulic cement, but the fear of trust prosecution may have been a factor. The capitalization of the subsidiary companies is about \$750,000.

Cement Products Exhibition at the Coliseum, Chicago, Dec. 17 to 21st, 1907. This building encloses the largest exhibition space in the West. For space apply to L. L. Fest, Manager, New Southern Hotel, Chicago.

Come to the Chicago Cement Products Exhibition Dec. 17 to 21st, where up-to-date Cement Machinery and Products will be displayed.

The Standard Concrete Stone Co., of Elizabeth, N. J., capital \$25,000, of which \$10,000 is preferred and \$15,000 common stock. Peter J. Olde, and Jno. H. Olde are the incorporators who are combining the concrete stone plants operated by the incorporators at Elizabeth and Roselle, N. J.

H. H. Henderson of Grand Rapids, Mich., has located a site for the manufacture of wooden concrete moulds at Denver, Colo. The lumber is to be brought from Seattle, Wash., and the moulds distributed throughout the Rocky mountain regions. This looks like a hot air project.

"It has been officially confirmed that the Seaboard Portland Cement company, which plant is to be built at Alsen, New York (clay and limestone proposition), have placed an order with the Lehigh Car, Wheel & Axle Works, Catasauqua, Pennsylvania, covering their entire pulverizing requirements, comprising forty-five 42-inch Fuller-Lehigh Pulverizer Mills, capable of pulverizing the coal, raw material, and clinker for their 6,000 barrel plant."

"The Hunt Engineering Company have placed an order with the Lehigh Car, Wheel & Axle Works, Catasauqua, Pennsylvania, for the necessary pulverizing machinery for the 2,000 barrel plant (shale and limestone) being built at Chanute, Kansas, for the Ash Grove Lime & Portland Cement Company."

The Fuller Engineering Company of Allentown, Pa., have taken the contract to build a 4,000 barrel daily capacity cement mill for the Allentown Portland Cement company. Work will commence upon this plant at once, and it is expected that the plant will be in operation the first of July, 1908.

Among other contracts which the Fuller Engineering Company has, are the plant for the Blue Sea Portland Cement company to be built at Courtney, Mo., and the plant for the Matcham Portland Cement company to be built at Evansville, Pa.

The Sandusky Portland Cement Co., Sandusky, O., manufacturers of Medusa Water-proof compound, report that that material was used in the following work:

Concrete foundations and cement plaster coat on the light well in

the new concrete office structure known as the Pacific Bldg., San Francisco. In the construction work in the new plant for the District of Columbia Paper Mfg Co., Washington, D. C. By the Aberthaw Construction Co., in concrete tanks and water filter for the Woronoco Paper Co., near Boston, Mass. For stopping leaks in the Illinois Tunnel Co., concrete subway work, Chicago, Ill., and by James Stewart & Co., contractors, in the Linoleum plant being constructed by them at Lancaster, Pa.

The Acme Cement Co. (cement & plaster mill), at Russell, N. Mex., reports a good trade. Cottages for its employees and a school house are being built by the company.

The Great Western Portland Cement Co. has been incorporated to erect a plant 5 miles south of Kincaid, Allen Co., Kans., 86 miles south of Kansas City on the line of the Missouri, Kansas and Texas R. R., and 3 miles from the Missouri Pacific railway, to which spur tracks will be built. The company's holdings consist of 235 acres of limestone land from 20 to 30 feet in depth, under which a deposit of shale averaging 55 feet thick is found. The rock is similar to that found at Iola in the same county. The promoters claim to have found an inexhaustible supply of natural gas on the land. The water supply will be drawn from a tributary of the Osage river. A new town is being laid out on the company's property to be called Mildred. The plant is to have a capacity of 3,000 bbls. per day. The contract for the plant has been let to the Clay Construction Co., of Kansas City. Four kilns will be installed at first, and more added to bring the plant up to the capacity named. The company's office is in Kansas City, Mo. The officers are as follows: John W. Wagner, Pres. of the German American bank, Kansas City, President; Sam T. McDermott, Vice President; E. H. Estek, Excelsior Springs, Mo., Treasurer.

Several hundred new culverts will be constructed in Johnson Co., Mo., at the last meeting of the County Judges at Warrensburg, the county seat, it was decided to start in with two concrete culverts. The wooden culverts the Judges say are becoming a constant drain upon the available funds for road construction, as they are constantly out of repair, while the concrete culvert once in place will last indefinitely and will be cheaper in the end.

The Colorado Cement and Plaster company; Whitney Newton, G. W. Bartholomew, Charles Boettcher, H. C. James and R. B. Sullivan; \$50,000; Denver, Colorado.

Cape Girardeau Portland Cement Co., Portland; cement and allied products; capital, \$1,500,000. President, J. E. Manter; treasurer, C. E. Eaton; Clerk, M. W. Baldwin, all of Portland, Mo.

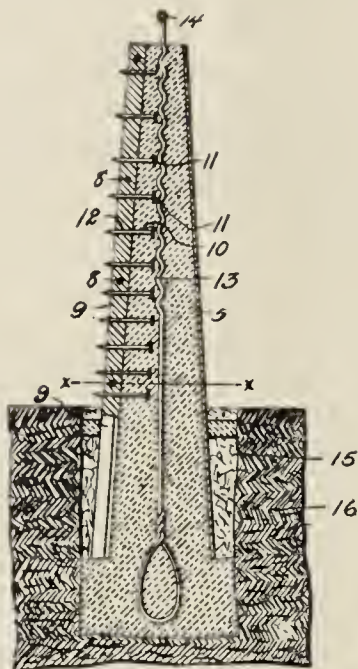
RE-ORGANIZING.

The Raven Lake Cement Co., of Raven Lake, Ont., on the Grand Trunk railway is to be re-organized. the company made an assignment to H. R. Morton. The assignee's report shows a loss of \$52,000 during the last three years. The books show a nominal surplus of \$350,000. The committee appointed to devise a scheme for reorganization recommend a new charter with a capital of \$1,000,000, of which \$500,000 is to be preferred and \$500,000 common stock. That the first and second mortgage bond holders whose combined claims amounting to \$120,000, be given the same security in the new company; the directors who advanced \$37,500, and the general creditors with claims aggregating \$20,000 to be secured by second mortgage; an additional \$72,000 second mortgage bonds to be sold to rebuild the plant; the shareholders in the old company to exchange their holdings share for share in the new organization. After a thorough discussion of the subject, the share holders declined to permit the sale of the second mortgage bonds, agreeing to take the company's stock and pay \$20 for each \$100 share and thus avoid going into the market for the money required to rebuild the plant.

The Atlantic Cement Company, whose office is at 439 Fifth avenue, N. Y., made an assignment yesterday to Benjamin F. Elgar 2nd, of White Plains, who is president of the company. Later in the day a petition in bankruptcy was filed against the company. In January last the balance sheet showed assets \$209,000 and liabilities \$126,000. The company did a large business and had yards at 201st street, Harlem River, 135th street and Mott Haven Canal, New Rochelle and Jersey City. A few months ago there was a change of management. Benjamin F. Elgar sole 2nd Vice President became President and Frank Vernon, 2nd Vice President.

U. S. PATENTS RELATING TO CEMENT AND CONCRETE.

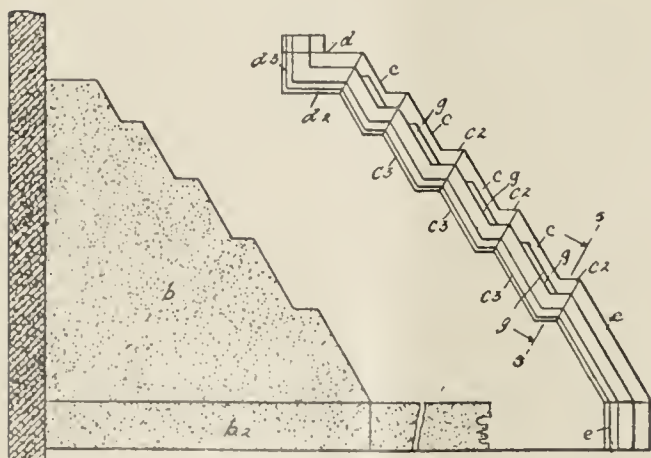
866,653. Mold for Cement Posts. Charles Hutchins, Pataskala, Ohio. Filed June 14, 1906. Serial No. 321,605.



No. 1.

In a device of the character described, the combination with a flexible and integral mold body which is open entirely along one side thereof and which tapers toward its upper end, of an outturned flange formed upon the mold body at each side of its open portion, a strip having a series of centrally arranged perforations formed there-through which are adapted to receive fastening devices that extend from the center of the post to be molded, said strip entirely filling the space between said flanges and being adapted to be stripped bodily from the fastening devices when moved away from the mold, and bolts removable from the exterior of the mold which pass through both the flanges and the strip.

866,833. Construction of Concrete Aqueducts, Tunnels, Subways, and the like. James T. Wilson, New York, N. Y. Filed Feb. 18, 1907. Serial No. 357,802.

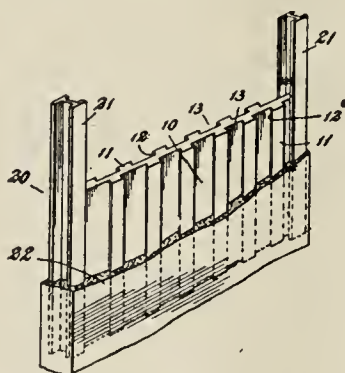


No. 2.

7. The herein described means for forming concrete walls for an aqueduct, tunnel or other structure, comprising inner and outer shells between which the side and top

walls are formed, the inner shell being higher at the bottom than the outer shell, side and top molds movable between the shells, and a bottom mold operating in connection with side molds and adapted to be moved therewith forwardly step by step, the faces of said molds being provided with tongues and grooves which extend longitudinally thereof, and the side molds being composed of horizontal bottom portions and upwardly and backwardly inclined top portions, and means for locking the side molds together and for forming locking grooves in the concrete.

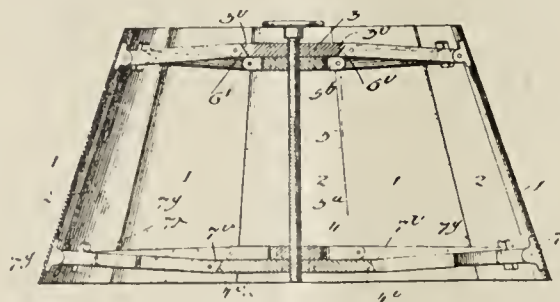
867,251. Building Construction. Lewis K. Davis, New York, N. Y. Filed Sept. 17, 1906. Serial No. 334,998.



No. 3.

A wall comprising a plurality of solid thin flat tiles of ceramic material, said tiles having parallel flaring ribs projecting from opposite surfaces of the tile, the ribs on one surface of the tile being between those on the opposite surface of the tile; metallic I-beams receiving the opposite vertical edges of the tiles between the flanges of said beams, and a body of concrete surrounding said tiles and beams and forming the outer surfaces of the wall and binding the tiles and beams together.

867,431. Collapsible Inner Shell for Molding Tapering Pipe. Charles L. Simpson, Minneapolis, Minn., assignor to Miracle Pressed Stone Company, Minneapolis, Minn., a Corporation of South Dakota. Filed June 29, 1907. Serial No. 381,414.

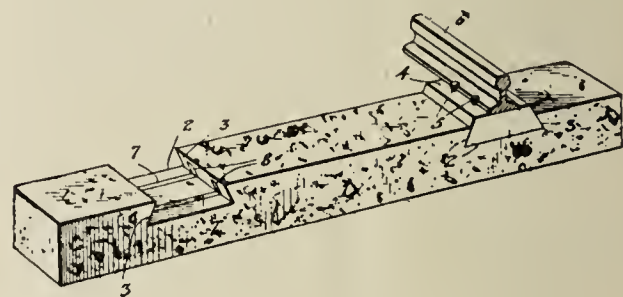


No. 4.

3. An inner member of a pipe mold consisting of an expansible and collapsible shell comprising two sets of segmental plates, the plates of one set being lapped outside those of the other set; an axial screw shaft oppositely threaded at its opposite end portions; two travelers

engaged with said oppositely threaded portions respectively; links which connect the travelers respectively to the opposite ends of the segment plates, the links for the outer-lapped plates being pivoted to the travelers at transverse planes inward from the plans at which the links for the other set are pivoted, all the links from each spider being pivoted to the segments at substantially the same transverse plane.

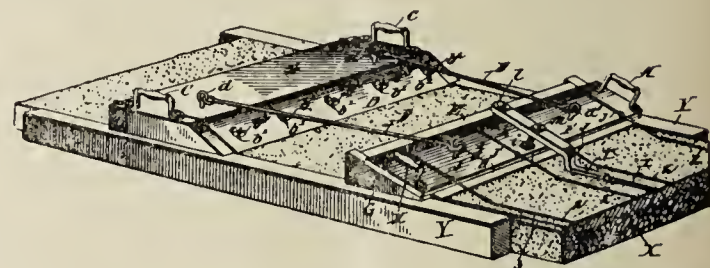
867,435. Railroad-tie. John C. Speaker, Magnolia, Ohio. Filed Feb. 18, 1907. Serial No. 358,140.



No. 5.

1. A cross tie comprising a body of plastic material having seats in its top for track supporting blocks, and a longitudinally extending metallic reinforcing member embedded in said body and having seats to register with the seats in said body.

867,852. Device for Laying Concrete Pavements. George W. Switzer, Salisbury, N. C., assignors of one-third to Henry G. Campbell, Salisbury, N. C. Filed Feb. 28, 1907. Serial No. 359,717.



No. 6.

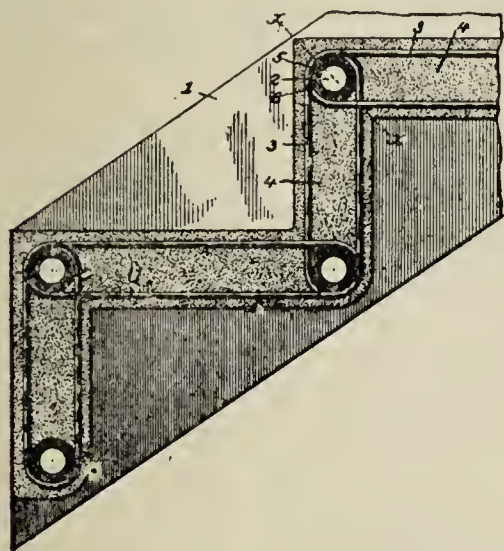
1. A device for laying concrete pavements, consisting of a straight bar having a broad flat base, a narrower upper surface and a beveled rear edge with an adjustable trowel affixed to said edge and also having handles at its opposite ends and downwardly projecting transverse fins on the base side of its opposite ends arranged to define the marginal edges of the pavement and form guides.

2. A device for laying concrete pavements, consisting of a straight bar having handles at its opposite ends and downwardly projecting transverse fins on the lower side of its opposite ends arranged to define the marginal edges of the pavement and an adjustable straight metal trowel plate attached to the bar at one edge and capable of being extended below the bar to contact with the pavement to apply the

necessary compacting and smoothing pressure on the plastic material.

867,818. Reinforced Concrete Step. George M. Graham, Chicago, Ill., assignor to G. A. Edward Kohler, Chicago, Ill. Filed June 1, 1907. Serial No. 376,809.

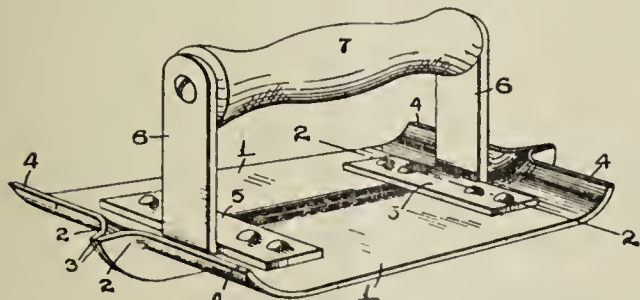
1. Reinforced concrete steps, comprising side stringers, a series of cross rails extending between said stringers and arranged in zig-zag relation, windings of wire connecting said rails, and a mass of concrete inclosing said rails and windings to form the treads and risers of the steps, substantially as set forth.



No. 7.

3. Reinforced concrete steps, comprising side stringers, a series of cross rails formed of round tubing and extending between said stringers and arranged in zig-zag relation, members arranged within said tubular cross rails and extending through the stringers and upset against the outer faces thereof, windings of wire connecting said rails, and a mass of concrete inclosing said rails and windings to form the treads and risers of the steps, substantially as set forth.

867,819. Cement-Worker's Tool. Frederick W. Grundmann, St. Louis, Mo., assignor to Crescent Novelty Manufacturing Company, St. Louis, Mo., a Corporation of Missouri. Filed May 15, 1906. Serial No. 317,016.

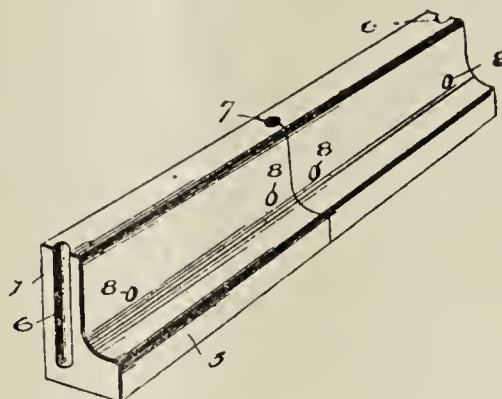


No. 8.

As a new article of manufacture, a cement workers' tool, comprising a pair of sheet metal plates having smooth bottom surfaces and having their meeting edges bent downwardly to form a longitudinal-

ly extending centrally disposed rib on the under side of the tool, both ends of which plates, together with the edges forming the ribs, being curved upwardly, means whereby the plates are rigidly connected, and a handle carried by the plate connecting means.

867,388. Curbing. Solomon W. Lerch, Manasquan, N. J., assignor of one-half to John M. Braly, Villapark, N. J. Filed Feb. 21, 1907. Serial No. 358,583.



1. A curb block having an up-standing retaining wall portion and an angular foot extension disposed at right angles to the body of the block, half round vertical bonding grooves in the ends of the block, and hand hold openings formed in the face of the block.

H. C. Eckels of Phoenix, Arizona, is preparing plans for a cement plant to manufacture the Keystone Fireproof cement, which has been introduced on the Pacific coast. Power is to be drawn from the U. S. government power plant at Roosevelt, which will utilize the power plant now under construction.

HIGH BUILDINGS IN NEW YORK CITY.

The City of New York has completed an inventory of high buildings within its corporate limits, which number 540, as follows 164 ten stories, 101 of eleven, 169 of twelve, 13 of thirteen, 18 of fourteen, 19 of fifteen, 19 of sixteen, 2 of seventeen, 9 of eighteen, 2 of nineteen, 9 of twenty, 4 of twenty-two, 2 of twenty-three, 3 of twenty-four, 3 of twenty-five, 2 of twenty-six, 1 of fortyone, 1 of forty-eight. Making 540 tall buildings all erected during the past 17 years.

Cement Products Exhibition at the Coliseum, Chicago, Dec. 17 to 21st, 1907. This building encloses the largest exhibition space in the West. For space apply to L. L. Fest, Manager, New Southern Hotel, Chicago.

Write to L. L. Fest, New Southern Hotel, for exhibition space at the Chicago Cement Show.

BOOK NOTICE.

Selection of Materials to Produce Dense Concrete Mixtures from Various Aggregates. Covering investigations on the compacting of tamped aggregates by H. Nitsche, Dip. Eng. Sixteen pages, 7x10 inches, with numerous tables and formulas, illustrated and condensed into two graphic diagram sheets, which show the density and voids in given mixtures, with the percentages of cement required to thoroughly bond the concrete mass to form dense, sound and economical concrete. The formulas given enable the construction engineer to foretell the density of any concrete mass of which the aggregates have been examined and classified under the author's system and formulas, provided the concrete will have been properly compressed by tamping. The booklet can be obtained from the publisher, Wilhelm Engelmann, Leipzig, Germany. Price, 2 marks.

CHEMICAL RE-AGENTS—THEIR PURITY AND TESTS.

A new and improved text based on and replacing the latest edition of Krauch's "Die Pruefung der Chemischen Reagenten," by E. Merck, authorized translation by Henry Schenck, A. B. 250 pages, 6x9 1-2 inches. Price \$1.50. D. Van Nostrand Co., New York.

This is a valuable treatise, it contains exact specifications of re-agents which are in universal use, and meets the desire of American chemists to rid themselves of the misleading term C. P. and to obtain in its stead definite statements as to the exact degree of purity of their re-agent or the exact limit of the impurities. With this end in view, the American Chemical society appointed a committee of purity of re-agents in 1906. This committee reported against the publication of a book on this subject, because such a work would practically be only a duplicate of Dr. Krauch's treatise. At the time the committee made its report, Dr. Krauch's treatise could only be had in the German language. The authorized translation into the English language is now on sale with additions not to be found in authoritative American publications. Manufacturing chemists will find this treatise a valuable addition to their libraries.

Come to the Chicago Cement Products Exhibition Dec. 17 to 21st, where up-to-date Cement Machinery and Products will be displayed.

CEMENT USERS CONVENTION 1908.

The Fourth Annual Convention of the National Association of Cement Users will be held at Buffalo, N. Y., January, 1908, 20 to 25 inclusive in the old 65th Regiment Armory, Broadway and Potter streets. Full particulars and plats showing space to be allotted to exhibitors can be obtained from Mr. Dia. H. Lewis, 760 Main St., Buffalo, N. Y.

IN THE HANDS OF RECEIVERS.

The Bonneville Portland Cement Co. Works at Siegfried, Pa., has gone into receivers hands, H. C. Laughlin and Louis Saller having been appointed by Judge Sulzberger of Philadelphia on Oct. 23. The Bonneville Cement Co. has a capital of \$600,000 stock and \$600,000 bond issue. The company has not paid expenses, the President Joseph P. Mack claims that he had expended \$75,000 of his own money and that the attack on the company was a political move on part of a rival faction against the Mack interests, while the Durham faction claim the companies affairs were mismanaged. The plant produced 400,000 barrels per year.

ELECTRIC DUMP CARS.

The illustration herewith shows a novel, electrically driven dump car brought out by the Jeffrey Mfg. Company of Columbus, O., the well known manufacturers of electric locomotives and motor cars equipments.

This dump car is standard in design with a steel frame, constructed so that an electric motor can be attached for operating it. A simple form of under running trolley, together with controlling devices for operating the car are used, as will be seen in the illustration.

The dump car here shown has a capacity for handling 32 cubic feet

of earth of similar material but other sizes are manufactured to suit various requirements. An electric motor of proper capacity to suit the size of the car is geared to one axle by single reduction gearing. The total weight of the empty car with electrical equipment is, approximately, 2,900 lbs. It is capable of hauling a train of several other cars as trailers. It makes a very simple equipment, and one which will appeal to contractors who have access to electric power.

This type of electrically propelled dump car is said to be very easily handled and at a minimum of expense. Full data regarding equipments of this kind can be had by addressing the manufacturers.

CEMENT SHOW.

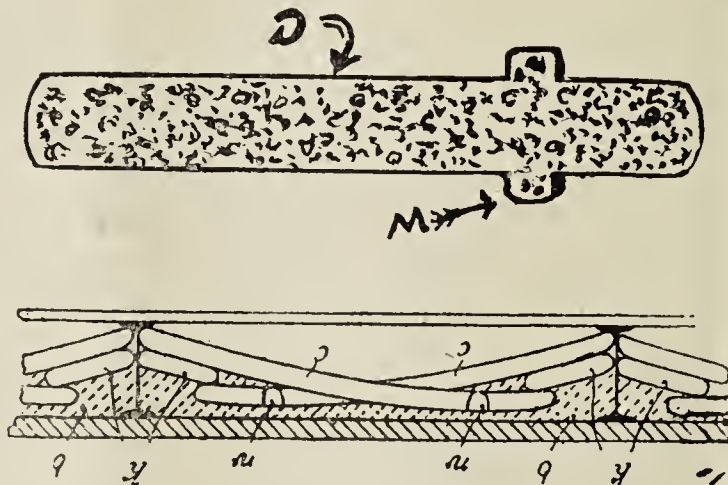
A national exhibition of cement products will be held at the Coliseum building under the auspices of the Cement Products Exhibition Company December 17 to 21, 1907.

The machinery will be exhibited in the Coliseum Annex.

fitting up of their spaces, the exhibition will be conducted upon strictly business principles. The best talent in Chicago will assist in making the exhibit a success. The Coliseum is the largest show building in Chicago. The cost for space which includes the fitting up of booth is 50 cents per square foot, except corner spaces, which will be 60 cents per square foot. There are 168 exhibition spaces in the main hall. Nothing will be left undone to make this Cement Products Show a complete up-to-date success.

ARCHED CONCRETE CONSTRUCTION WITHOUT TEMPORARY FALSE WORK.

Mr. Max Krausz of Munich, Germany has devised a new system of Arched Concrete floor construction which consists of bow shaped reinforced concrete plates or staves which are produced in the factory and carried in stock. These shapes have lugs or shoulders projecting from the edges as shown in W.

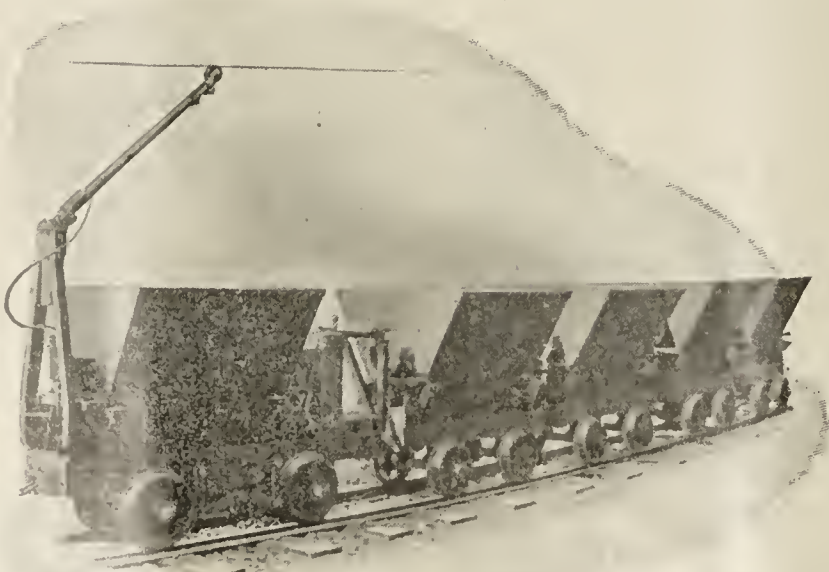


The booths will be prepared and made ready for the exhibitors by the manager, Mr. L. L. Fest, for which there will be no extra charge. This will be a great relief to the individual exhibitors who heretofore have not only paid for the space occupied but were compelled to make individual contracts for the

These pieces are assembled between two I beams as shown in the illustration. One end resting on the flange of the beam, the other end overlapping the center of the arch. The forms rising from each side of the arch. The projecting lugs rest on the two bow shaped pieces on either side, holding each stave shaped member in place. After the arch is thus formed two plates K are laid on the arch parallel with the I beams and under the ends of the stave shaped reinforced concrete forms. The Arch is then ready to receive the concrete all as shown in the illustration.

Write to L. L. Fest, New Southern Hotel, for exhibition space at the Chicago Cement Show.

Enter your Cement Machinery and Products at the great Chicago Cement Show, Dec. 17 to 21st, do so at once.



BARE ALUMINUM COILS FOR ELECTRO MAGNETS.

Demonstrations made in European laboratories show that bare aluminum wire coils can be used with advantage over the ordinary insulated wire coils on dynamos, depending upon the fact that aluminum surfaces become oxidized at ordinary temperatures. When placed in steam or water, these coils become hydrated at temperatures commencing at 302 deg. F. up to 572 degrees F., producing a layer of aluminum which has sufficient insulating properties for the use specified, besides affording better radiation from the coil, as well as being much lighter.

Position Wanted—Eastern Cement Chemist desires to make a change. Competent to take charge of any plant. References from past and present employers. Address C. C. E., care Cement & Engineering News.

Wanted Position as assistant chemist by a young man with college education and six months' experience in cement laboratory. Can give best of references. Address M. E. P., care Cement & Eng. News.

FOR SALE—A1 design of Concrete Mixing Machine, semi-automatic; patent applied for. Wert Schmacker, Webster City, Ia.

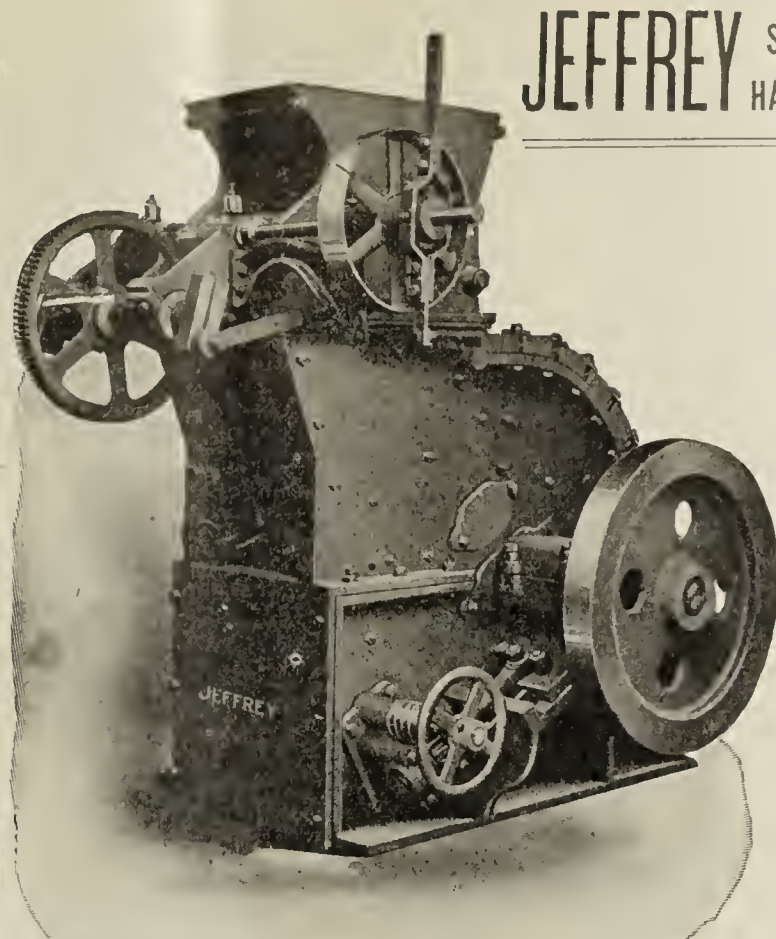
WANTED POSITION—As superintendent or manager by an experienced operator in both wet and dry processes. Address I. M. T., care Cement & Engineering News.

CEMENT CHEMIST—technical graduate—B. S. degree, wishes change of location; one and a half years' experience; both physical and chemical; would become assistant to manager in cement mill. Address G. D., care Cement & Engineering News.

SITUATION WANTED.

Chief chemist of four years' experience, with college training; presently employed but desires change of location. Desirable references can be furnished. Address D. B. O., care Cement & Engineering News.

Chemist at present in charge of slurry process, desires change as chief or assistant. Address B. M., care Cement and Engineering News.



JEFFREY SWING HAMMER PULVERIZER

Equipped with
**AUTOMATIC FEED,
WORM GEAR and
SCREW LOWERING DEVICE**

Fully described in Catalog 31
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ALSO MAKERS OF
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CHICAGO DENVER MONTREAL

Cement and Concrete

By **LOUIS CARLTON SABIN, B. S. C. E.,**
Assistant Engineer Eng. Dept. U. S. Army, Member American Society Civil Engineers

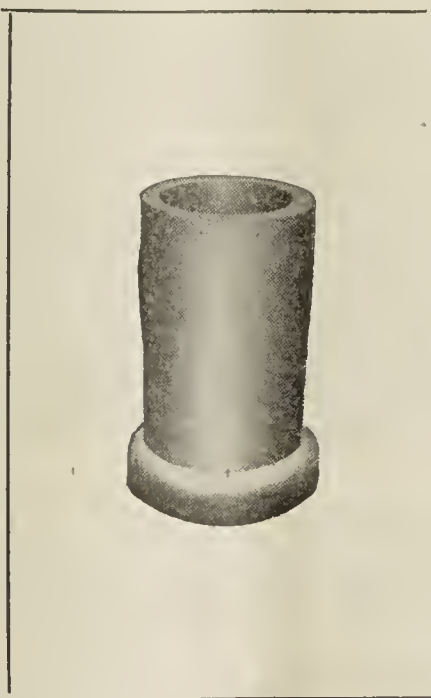
An up-to-date, thoroughly practical treatise on the use
of concrete, covering all branches of construction

Price, \$5.00

Mailed on the receipt of the price

CEMENT AND ENGINEERING NEWS

Chicago, Ill.



Concrete Manufacturers

YOUR HARVEST SEASON IS SOON TO OPEN.

Are you equipped to get all the profitable business in your line? Take sewer pipe. **\$34.50 will equip you with a 15" bell and pipe mold.** This size is mostly used by road supervisors for culvert work. The profits on one hundred foot of his pipe sold at clay prices will pay for a mold. This is certainly worth investigating. Had you not better send your order for a 15" size today?

CLARINDA TILE & BRICK FACTORY

PAUL O. COOK, Proprietor

Clarinda, Iowa, Dec. 17, 1906.

Miracle Pressed Stone Co., Minneapolis.

Gents:—The tile molds I find to be just the thing. We had a good sale of the tile, it was late in the year to buy these tile molds but we had a good trade. We made about 3000 ft. of 12 in. tile; 2500 ft. of 15 in. tile; and about 1500 ft. of 25 in. tile. I think the are better than clay tile. They will stand frost better, and the ol they get the better they are. A clay tile is no better than the day I s put in the ground—cement gets better the longer it is in the ound. I knew this to be true; I have made clay tile for 16 years and am still making them.

Yours

PAUL O. COOK.

Miracle Pressed Stone Co.,
Largest Manufacturers of Concrete Machinery in the World
MINNEAPOLIS, U. S. A.



THE
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**THE PERFECT
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OF
**Cement Rock and
Clinker, Coal, Phos-
phate Rock
and
all other refractory
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**Write for Catalogue and
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The regular courses in Mining Engineering and Metallurgy include a thorough training in Mathematics, Chemistry and Physics, as well as Surveying, Mineralogy, Lithology, Geology, Mining Engineering, Metallurgy, Steam Engineering, Hydraulics and Electric Testing with Laboratory Practice in Ore Dressing, Milling and Smelting, and with Summer Schools of Metallurgy and Mining. For catalogues address DR. HARRY W. TYLER, Secretary.

Brush Finished Concrete

We are taking orders for Tampico Fibre Brushes used in making the brush finished concrete. This finish resembles the finest cut stone work. Brushes delivered by mail at \$1.00 each. Address CEMENT AND ENGINEERING NEWS, 22 Fifth Avenue, Chicago.

Fire Brick Linings For Cement Kilns

STANDARD TESTING SAND AND
GENERAL BUILDING SUPPLIES

Garden City Sand Co.,
188 Madison St., Chicago



A satisfied customer is the best advertisement. He can and does BLOW OUR HORN to better advantage for us than we can.

Those who have bought of us and need more mills are giving us additional orders.

Our mills reduce HARD ROCKS to a fine powder in the twinkling of an eye.

STROUD MILLS

On most kinds of work, the

OUTDO ALL OTHERS

In quality of grinding and in output per horsepower per hour, and they grind for less money per ton.

Screen Separation Mills :: Air Separation Pulverizers

Crushing Mills
Disintegrating Mills
Pulverizing Mills
Shredding Mills

Our AIR SEPARATION PULVERIZERS produce, direct from the mill, any desired mesh, from say 40x40 down to the MOST IMPALBABLE POWDERS, at will of operator, at a moment's notice. Five sizes. :: All built practically alike. :: DUSTLESS IN OPERATION. :: Do away with sieving entirely.

E. H. STROUD & CO., ENGINEERS AND MANUFACTURERS
30-36 La Salle Street, CHICAGO, ILL.

ALPHA PORTLAND CEMENT....

Works, ALPHA, N. J

Quality unexcelled. The Recognized Standard American Brand. Always Uniform.
ALPHA PORTLAND CEMENT CO.
Manufacturers of but one grade—strictly straight Portland.
General Office, EASTON, PA.

DEALERS ATTENTION

As General Sales Agents of the York Portland Cement Company, we are now placing agencies for the sale of the product of this mill, *one of the most modern in existence*. Our policy will be to give *exclusive agency* in each town and sell to no one else. We will also include agencies for **Toch Bros. "R. I. W." Water Proof Point** and **"Stonkote" Plaster** in all colors for *Rough Cast Exterior* for houses. Your inquiries by mail will be answered in detail. Apply quick or your neighbor will get the agency you should have. Address



The Garden City Sand Company

Dept. 11, 188 Madison Street

Chicago

ARCHITECTS' AND ENGINEERS'
HANDBOOK OF

Re-Inforced Concrete Constructions

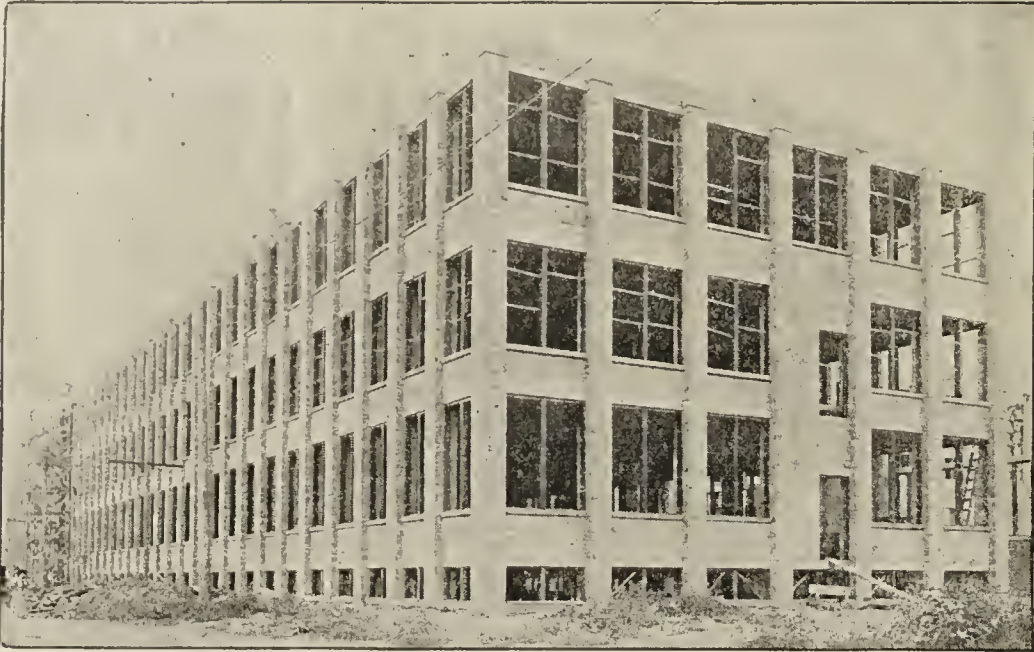
172 pages.

Illustration and Diagrams 217 pages.

By L. J. MENSCH, C. E.

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Cement and Engineering News
22 Fifth Avenue.....CHICAGO, ILL.



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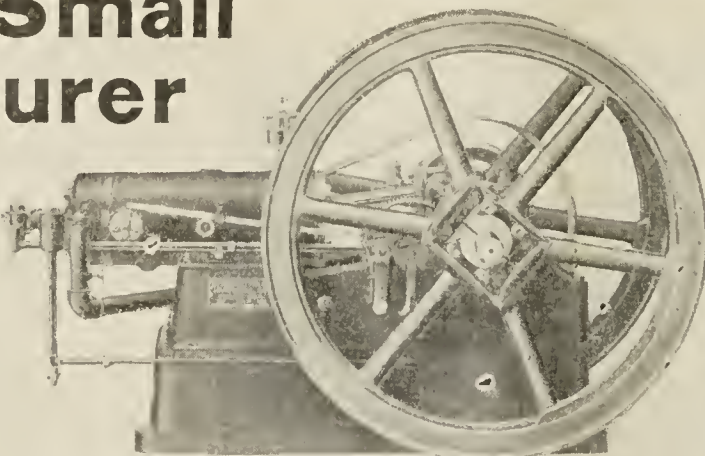
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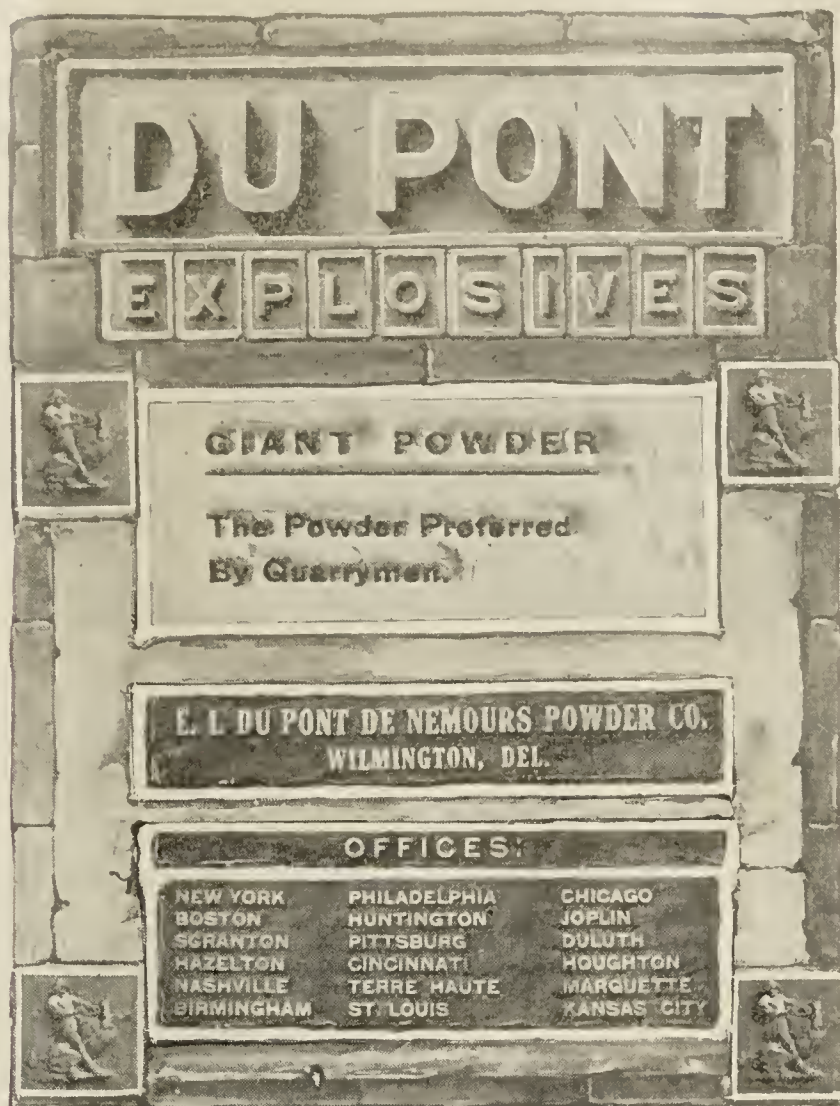
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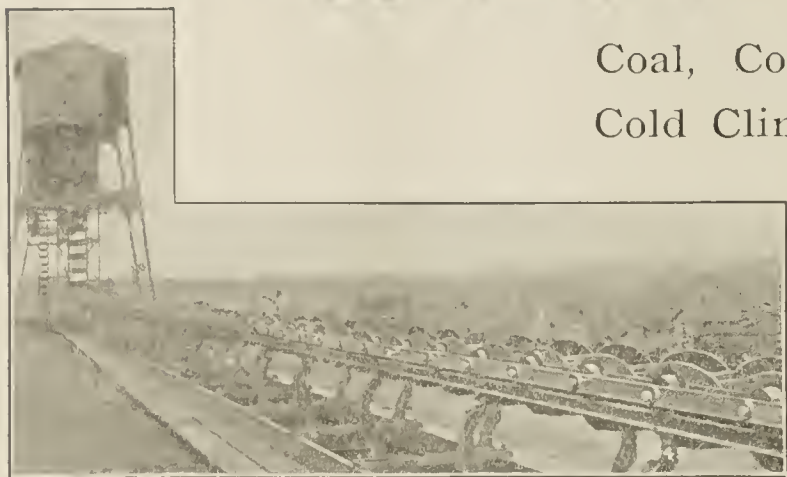
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Coliseum, December, 17-21, 1907

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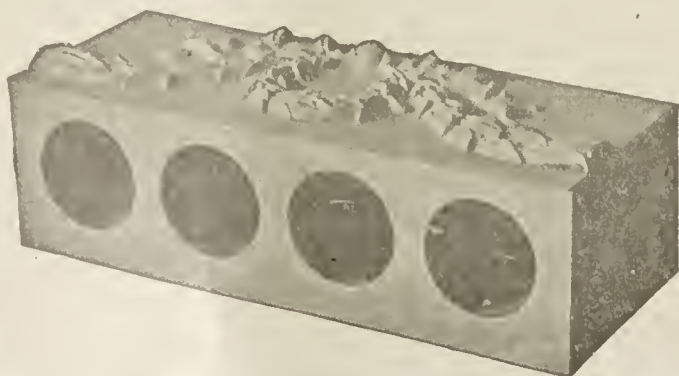
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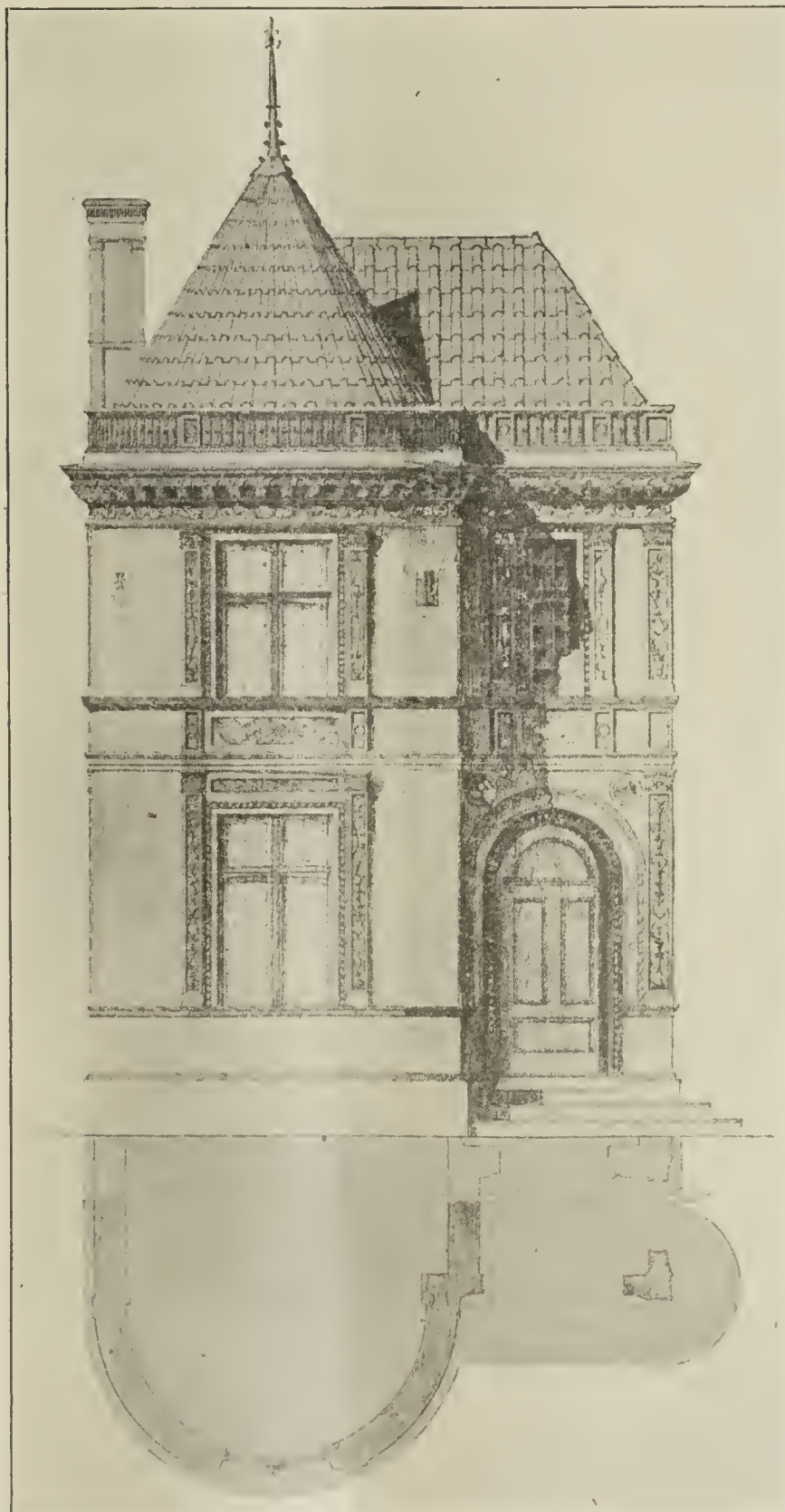
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CEMENT AND ENGINEERING NEWS

(PUBLISHED MONTHLY)

WILLIAM SEAFERT, Editor and Publisher

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This Paper is a Member of the Chicago Trade Press Ass'n

CHICAGO, NOVEMBER, 1907.

CORRESPONDENCE.

We solicit correspondence on all matters of general interest to the cement trade in all its branches. Engineering notes, public improvements, and facts and opinions drawn from practical experiments will be welcome.

CEMENT FOR THE PANAMA CANAL.

The United States government has been investigating the raw cement material deposits in the Panama canal belt, with a view of erecting a Portland cement plant to manufacture its own cement to be used in the construction of the masonry work in this great project. Something like 5,000,000 bbls. of cement will be required. Several deposits of cement raw material found near the line of the canal project have been tested at Allentown, Pa., and found satisfactory. The materials tested consist of coral rock found near Colon rather high in iron which will produce a cement that will withstand the action of sea water much better than the ordinary Portland cement being much like the Sedro or iron ore cement controlled by patents owned by the Krupp iron works. Clay from the Charges river, or the old French excavations make a suitable mixture. A rhyolite tuff of volcanic origin found near the Panama river can be used with or without the clay to furnish the required silica and aluminum to go into the mix. The Government has estimated the cost of a cement plant to be located on the Isthmus between Colon and Gatun at \$1,500,000, to have a capacity of 1,000,000 bbls. annually, where cement is to be made at \$1.34 per bbl. based upon the following estimate: Fuel for power and burning 69 cts. per bbls, raw material from the deposit to the mill 15 cts. labor and grinding 12 cts. cost of plant and interest, 39 cts. This scheme of building cement plants is

an innovation introduced by the present administration and commenced with the government cement mill at Roosevelt, Ariz., and is in line with principles advocated by socialists who desire to control and operate all industries, and thus suppress individual or private Corporation ownership. At present prices cement can be laid down in cargo quantities at Panama at less than the estimated cost of production on the Isthmus.

CEMENT SHOW.

The first annual cement show will be held in Chicago at the Coliseum, December 17-21, 1907.

The Exposition will be held under the auspices of the Cement Products Exhibition Company, a company incorporated under the laws of the State of Illinois for the purpose of holding annual expositions of cement products. The enterprise is being promoted by Portland cement manufacturing interests of the Middle West, and is being actively supported by the leading periodicals devoted to the industry as stockholders in the company, including such representative papers as Rock Products, Cement World, Cement Era, Construction News, American Contractor, Engineering-Contracting, Cement and Engineering News, The American Lumberman, etc.

The Exposition will be of great educational importance, and will accomplish a good work in advancing the interests of the industry. The scope of the Exposition may be judged from the outline of the various divisions of exhibits as follows: Cement, concrete mixers, block machines, brick machines, cement pipe machines, cement tile machines, cement post machines, cement coloring mixtures, reinforcing metal, cement publications, testing machinery, sheet piling, aggregates, sand, technical institutions, etc.

The management of the show has been placed in the hands of Mr. L. L. Fest, an experienced manager of great trade exhibitions of this nature. His connection with the affair is of itself an assurance of success.

The time of the Exposition is opportune, coming as it does during the Holiday season when the cement men from all over the country may come to Chicago, both for the purpose of seeing the show and doing their Christmas shopping at the big stores of Chicago.

It is sincerely hoped that everybody directly or indirectly interested in the cement industry will do something to contribute to the success of this great demonstration intended to exploit cement as the

leading building material of the future.

A NEW CEMENT SLATE COMPOSITION.

Cement slate is now made from Portland cement and abestos fibre. The cement is dissolved in water to the consistency of a mineral jelly, which is mixed with asbestos, and subsequently treated just about the same as paper pulp; the water being pressed out, and it is then formed into thin sheets or boards to the required thickness. (Mineral jelly is now referred to as gel). The cement in being converted into a gel swells to some twenty times its original bulk. The gel is suspended in water in the form of flakes after the cement has been dissolved. This process is an entirely new and radical departure from the old methods of using cement. In the manufacture of cement products, the gel treatment can be used in making fire-proof doors of any convenient size, as it possesses remarkable fire resisting properties, which cannot be surpassed by any other combination of building materials, where lightness, strength and economy are desired. These sheets can likewise be used to displace marble slate and glass for switch-boards in electrical power stations. The crushing strength is much higher than the average roofing slate. There is a great field for this class of cement roofing slate as will be seen from the following natural slate roofing data, compiled from the latest government reports just issued, viz: The value of slate produced in 1906 was \$5,668,346 of which 1,241,740 squares were sold for roofing purposes valued at \$4,487,786. These prices are at the quarry. Kidder's Architect's and Builder's hand book gives the price per square, laid, at from \$7.00 to \$13.00. One square will measure 100 square feet. Slate is laid with a 3 inch lap or 9 inches to the weather. The entire process for making this Portland cement gel and its subsequent treatment, is given in a booklet entitled, "The Hardening Process of Hydraulic Cements," by Dr. W. Michaelis, Sr., published by the Cement & Engineering News, price 50 cts. With the introduction of cement gel, the manufacture of cement shingles and cement boards is upon us, and will open up a widely extended field for the use of cement not heretofore dreamed of by practical men.

Enter your Cement Machinery and Products at the great Chicago Cement Show, Dec. 17 to 21st. Do so at once.

ELECTRIC DRIVE ON CEMENT PLANTS.

The manufacture of Portland cement has certain features which differentiate it commercially from almost any other industry. The raw materials underlie more than 20 per cent of the entire area of the United States. Their initial cost is low, the cost of quarrying and dredging is slight, and, owing to the eager market, and more particularly, to the widespread deposits of raw

materials, in eliminating line shafting and adding to flexibility and economy, have now been almost universally demonstrated. These general advantages apply with equal weight to cement operations. These are, however, certain inherent requirements in the manufacture of cement which completely establish the argument in favor of electric motors for this class of work.

The most efficient method of operating the different processes in

ing much attention and not damaged by the extremely dusty conditions prevailing in all cement plants.

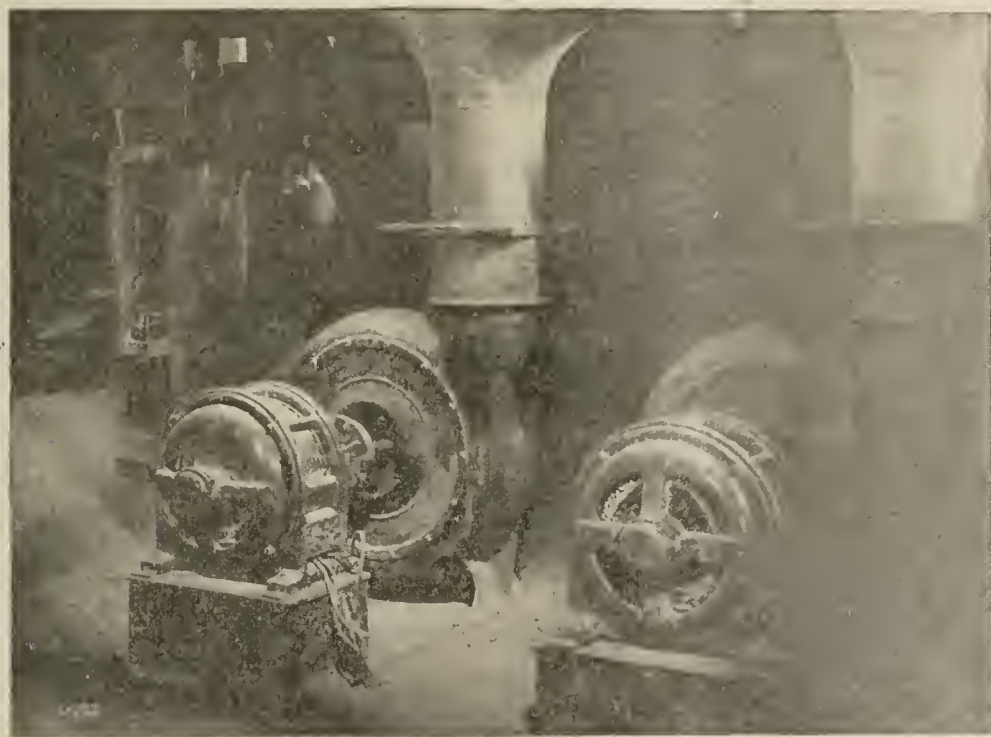
A complete electrical installation, composed of two or more engine driven, or turbo generators, switchboard, and the proper motor equipment consisting of alternating current, induction motors, will successfully meet all the above conditions.

As long as the boilers produce steam, continuity of operation is assured. Both the motors and generators will run without shut down for any desired length of time. The individual electric motor drive allows for the independent shut down or starting of any one of the cement machines, without affecting the operation of any other.

The location of the power house need not be considered in laying out the plant. In case water power is available at some distance from the mill, the generating station may be located at the source of power and the electric power transmitted at high efficiency to the cement plant. No line shaft need be considered in designing the mill, and the machines may be placed wherever most convenient to feed or discharge. This results in a great saving of floor space and improvement in design.

The switchboard can be laid out to have a separate feeder circuit for each of the departments, with a recording wattmeter in each feeder, and an indicating ammeter on each of the motor panels. If the board is still further equipped with a recording wattmeter on each generator panel, a complete check on all power used is obtained. Any increase or loss in efficiency of any department can be instantly noted, and the cause ascertained. This record will be found a great aid in working towards higher total efficiency and in lowering the cost of production.

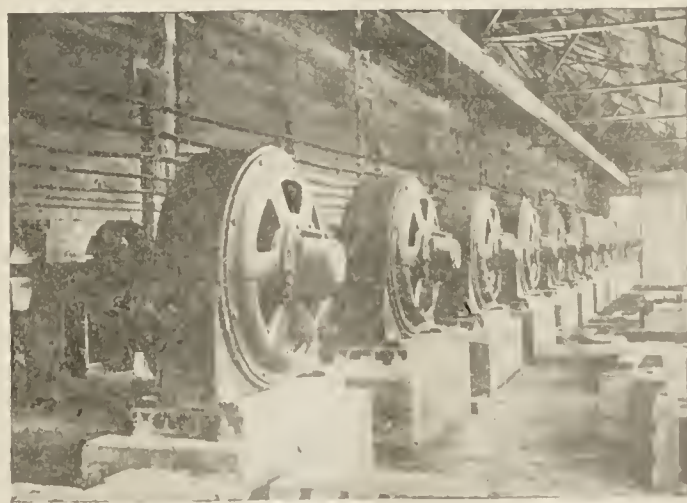
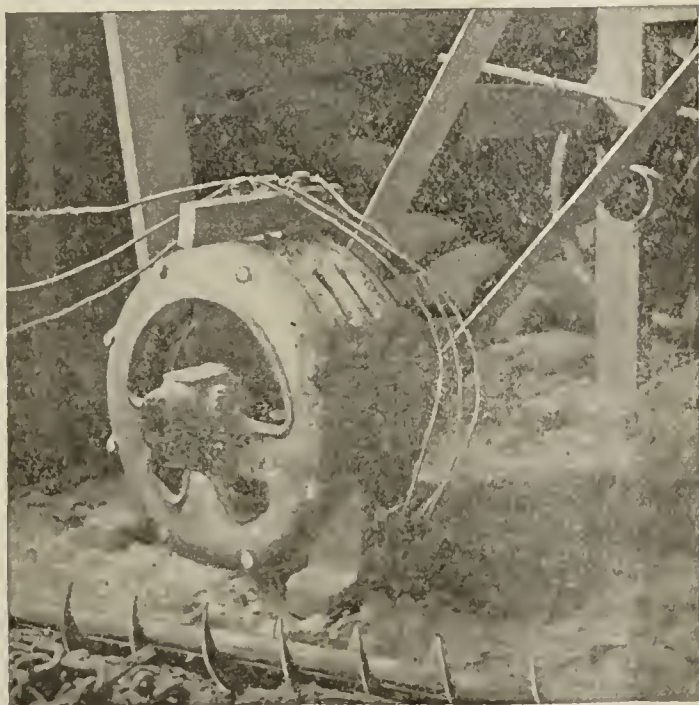
The form K. induction motor, made by the General Electric Co., and recommended especially for this class of work, is given the normal

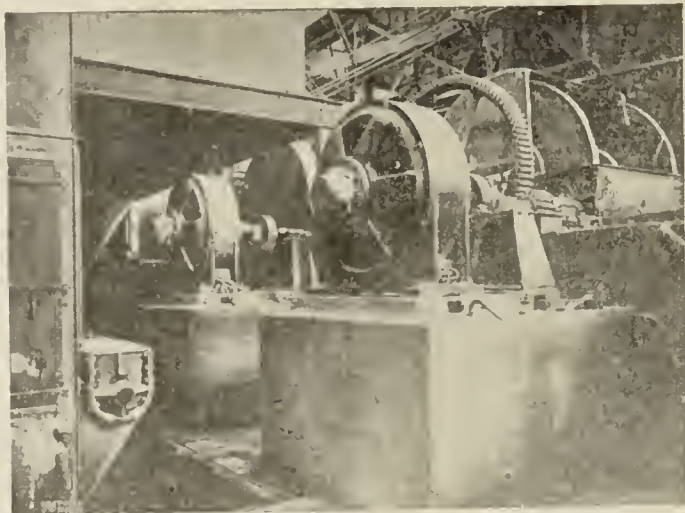


materials, no successful merger can be formed to regulate the selling price. The price of the finished cement is determined almost entirely by the actual cost of the different operations through which the raw materials passes. In the light of this fact, it is obvious that the most prosperous companies will be those that adopt, at the outset, the cheapest and most efficient means of operating the various machines necessary in cement manufacture.

The advantage of individual electric drive in machine shops and fac-

a cement plant must fulfill the following conditions; the entire plant must be in continuous production 24 hours a day and 7 days in the week, and the shut down of any one machine must not effect the operation of any other machine: the layout should be flexible and not dependant on the operation of line shafting or stem piping: an accurate check must be kept on the cost of manufacturing; machines must be adapted for heavy overloads at starting or when operating; the prime mover must be rugged, not requir-





running horsepower rating of the machine it drives. These motors are supplied with high resistance rotors for producing a starting torque of twice normal torque if necessary. The rotor bars are bolted to the end rings instead of being soldered, which enables the motor to stand the heavy current required for starting. These motors will endure short overloads of 200 per cent to 300 per cent. They are exactly suited to the duty, running at highest efficiency under normal load.

absolutely nothing to be injured by guards on each side. The compensators for starting these motors are arranged with a latch, so that the operator cannot throw the motors directly on the line until they start to run, once running, they can be left all day without attention. They are protected,—and in turn protect the machinery,—against excessive overloads, by fuses or circuit breakers on the starting panel. The revolving part is nothing more than a number of copper rods,



with a large margin of overload for starting, when required.

The first applications of electric drive to this manufacture were made before the merits of the alternating current for power were fully demonstrated. The General Electric Co., has installed direct current equipments in a number of plants with great success, notably in the Edison Portland Cement Co., at Stewartsville, N. J. Among the electrical apparatus at this plant, are ten 25 h. p., slow speed, variable speed motors driving rotary kilns 150 feet long, the heaviest kilns in the world. Where it is possible for the mill designer to determine the character of the power to be used, however, the best practice is to install alternating current of 25 or 60 cycles. Form K., induction motors operating on this current, are peculiarly adapted to the severe service of cement plants. There are no sliding contacts; no current carrying parts exposed to the air—

paralleled to and surrounding the shaft, and embedded in an iron core with their ends connected by rings at each end. Owing to the appear-

ance of this rotor, it is commonly known as the "squirrel cage type." There is nothing more complicated about it than a piece of shafting revolving between journals. Dust cannot hurt these motors. It is almost impossible to damage them. It would be hard to find any driving machinery more nearly "fool proof."

In the present stage of the cement industry, it is doubtful if any new plant can be profitably operated with a capacity of less than 1,500 barrels per day. Results obtained from a great many cement plants, indicate that the horse power varies from 0.8 to 1.2 h. p., per bbl., capacity. Unless electric power can be bought at an exceptionally low price, it will be found cheaper in the end to install a complete generating plant to furnish this power. Besides the factor of economy, this will eliminate all chances of a shut down of the plant resulting from exterior causes.

The load of a cement mill is steady, and its load factor high, sometimes above unity. For industrial conditions, when the load is steady and can be closely calculated, it is a decided economy to install generators rated according to the maximum output. For a 1,500 barrel plant, two 750 kw. turbo generators will be ample, and will be worked constantly as their highest efficiency. These generators are designed especially for the low power factor load caused by induction motors and will give the rated output continuously at 80 per cent power factor.

The Jeffrey Manufacturing Company of Columbus, Ohio, have for a long time been building electric driven auger drills for use in coal



Electric Coal Drill.

mines, and have recently brought out a heavier type, as shown in the accompanying illustration, and known as the A-5 drill. This drill is to be used for drilling gypsum, fire clay, rock salt, and other material of about the same hardness.

The motor is of ample capacity to take care of the most severe service that the drill point will stand, and has a nominal rated capacity of 3 h. p., with a momentary over load capacity of from 6 to 8 h. p. The gearing may be arranged for auger speeds from 100 to 300 r. p. m., and the thread bar provided with square threads from 6 to 12 per inch.

MERCK'S 1907 INDEX.

This book is a Chemical Encyclopedia, it gives the names of thousand of chemical preparations manufactured by Merck & Co., of Darmstadt, Germany, St. Louis, Mo., and Railway, N. J., being one of the most exclusive chemical manufacturing houses in existence. The 1907 Index gives the names, synonyms, the sources and origin, chemical nature and formulas, physical form, appearance and properties, melting and boiling points, solubilities, specific gravities and methods of test, physiological effects. Special caution hints on keeping and handling of chemicals used in chemistry, medicine and the arts. It contains 472 pages, cloth bound and will be sent on application for 25 cents. Address, Merck & Co., New York.

This country produced 28,301 tons of mineral paint and mortar colors in 1906 valued at \$315,746. Pennsylvania is the largest producer, New York second.

WHITE PORTLAND CEMENT.

The Sandusky Portland Cement Co., is placing upon the market a White Portland Cement which possesses all of the desirable properties of the best gray Portland cement excepting only that it is pure white in color; therefore suitable for high grade ornamental concrete work which can compete in artistic effect with granite, marble and enameled terra cotta, for exteriors of buildings as well as for columns, railings, steps, door and window casings, belt courses and cornices. It will make an ideal finish or facing for concrete building blocks when used with medusa water-proofing. The block will not only be white but absolutely damp-proof. White cement can be given any desired shade or tint required by architects. For interior work, white cement can be used for stair cases, wainscoting,

floors; and when ground up with white lime stone it can be substituted for Keen's cement in making cast statuary, which when brushed, finished or lightly washed with dilute acid, will sparkle like genuine marble from which it can scarcely be distinguished. For laying up brick or stone work, white cement will produce a stainless mortar. For prices on large or small shipments, and for full information as to agencies, address, Sandusky Portland Cement Co., Sandusky, O.

FILE TESTING MACHINES.

Since the introduction of file testing machines, the cutting value of files has been greatly increased. A large number of English and American files tested on these machines show a remarkable difference in quality. Some files would only cut 1 cubic inch of iron per 10,000 strokes, while others removed 12 cubic inches of metal per 10,000 strokes under identically similar conditions. Files are now made that will cut at the rate of 8 cubic inches per 10,000 strokes, while a single file has removed 55 cubic inches of iron by one side of a file.

SCALE OF HARDNESS OF MINERALS.

For the purpose of grading the hardness of minerals an arbitrary scale has been adopted known as Moh's scale; it is based upon the power of one mineral to scratch or wear away or to be scratched or worn away by other minerals. This scale takes note, and classifies mineral under 10 different degrees of hardness represented by the following minerals; 1. Talc, 2. Gypsum or Rock Salt, 3. Calcite, 4. Flourspar, 5. Seapolite, 6. Felspar, 7. Quartz, 8. Topaz, 9. Corundum. This scale of hardness does not refer to the resistance which a body offers to com-

pression or to a blow; the hardness of gems and other minerals is tested and compared with this mineral scale. Thus is a mineral will scratch or wear away felspar and not quartz, it will be classified as having a hardness of 6. Rock salt and gypsum possess the same scale of hardness, as both will scratch talc, but neither will scratch calcite.

The Pittsburg Plate Glass Co., has placed on the market, a white opaque glass under the trade name of Carrara Glass. It is used for wainscoting and wall covering, and can be used for the same purposes as marble at about the same cost. It comes in large or small plates from 1-2 to 2 inches thick. It can be used for doors into which locks are fitted.

A NEW WATERPROOF CEMENT.

Richard Lebold of Berlin, and Emil Wittig also Conrad Grimm of Meisen have patented a waterproof Portland cement composition, composed of a soapy fatty acid combined with resin, to each 210 pounds of clinker which must be warm, to which is added either 9 1-2 ounces of Japan wax or 8 oz. stearin. The mixture is then dissolved in hot water and thrown over the clinker, which dries out rapidly when it is ready for grinding. This patent is similar to the former patent granted to Liebold for a waterproof cement, several years ago.

Cement Products Exhibition at the Coliseum, Chicago, Dec. 17 to 21st, 1907. This building encloses the largest exhibition space in the West. For space apply to L. L. Fest, Manager, New Southern Hotel, Chicago.

IMPORTS OF CEMENT INTO THE UNITED STATES.

WHERE FROM	SEPTEMBER				NINE MONTHS ENDING SEPTEMBER			
	1906		1907		1906		1907	
	Quantity in lbs.	Value in Dollars	Quantity in lbs.	Value in Dollars	Quantity in lbs.	Value in Dollars	Quantity in lbs.	Value in Dollars
United Kingdom	57,861,850	\$174,340	88,000	\$ 474	125,273,746	\$367,711	145,342,016	\$ 501,272
Belgium	25,962,289	83,185	198,400	536	138,872,533	483,511	191,759,985	568,156
France	645,166	1,614	1,080,529	4,745	8,518,582	29,050	10,586,129	39,849
Germany	39,702,012	116,714	33,812,082	117,836	181,702,645	605,153	240,629,972	779,279
All Other Europe	9,921	96	..	..	298,253	920	930,263	2,129
British North Am.	200,020	1,499	29,900	189	2,655,340	18,408	311,550	1,968
Other Countries	6,425,586	30,027	793,656	4,244	59,700,404	273,616	5,631,874	30,128
TOTAL	130,806,844	407,466	36,002,567	128,024	520,021,503	1,778,372	595,195,089	1,922,781
Domestic Exports of Cement, bbls.	50,645	82,929	80,976	126,055	118,310	714,187	676,792	1,110,077

There were 11,280,987 lbs. of imported Roman and Portland Cement, etc., in the United States bonded warehouses in Sept., 1906, valued at \$33,901, against 11,696,612 lbs. in Sept., 1907, valued at \$2,231.

For nine months ending in Sept., 1906, there were 71,300 tons of asphaltum imported in the United States, valued at \$288,338, against 90,091 tons imported in nine months ending Sept., 1907, valued at \$576,769.

MEADE TESTING LABORATORIES.

The Meade testing laboratories have been established at Nazareth, Pa., for the inspection and testing of cement, conforming to the specifications of the American Society of Civil Engineers, as well as any special tests required by engineers and architects. Mr. Richard K. Meade, director of these laboratories is an eminently qualified cement expert, being the author of the most modern treatise on the manufacture of Portland cement, as well as the editor of a leading chemical journal. With years of experience in the manufacture of Portland cement in the Lehigh region, Mr. Clarence E. Kline, engineer of tests has had a wide range of experience in this particular line.

The Meade Testing Laboratories will make a specialty of the inspection of cement at the mill, their location in the centre of the world's greatest Portland Cement producing section enabling them (except in a few rare cases) to have tests upon the shipment completed before its arrival at the point of use, enabling the contractor to immediately unload and use the cement, thus saving demurrage charges upon the cars, or extra handling and storage of the cement.

The inspection of cement upon large orders will also be undertaken at other points than at Lehigh Valley Mills.

These laboratories are entitled to the fullest confidence of the public, requiring their service.

The quantity of coal consumed in the manufacture of coke in 1906 was 55,746,374 short tons valued at \$62,232,524. The coke produced from this quantity of coal is valued at \$91,608,034. The old bee-hive coke ovens are being slowly displaced by retort or by product ovens in which more coke per unit of coal is produced, besides recovering of valuable by-products, gas, tar and ammonia which find a ready market.

The State Geological Survey of Illinois has published circular No. 2 covering mineral production of the State for 1906, from which we abstract the following: The production of Portland cement is given at 1,858,403 barrels valued at \$2,461,494, while the natural hydraulic cement produced is valued at \$188,262.00, the natural rock cement showing an increased value of \$11,707 over 1905. The petroleum out-

put for 1906 was 4,397,050 barrels, valued at \$3,275,802.00.

LEAD WOOL FOR CAULKING PIPE JOINTS.

The Lead Wool Co. of Snodland, Kent, England, are manufacturing a new wool fibre lead which consists of fine cut lead made on patent machinery; it comes in strands slightly twisted in which form it is used for caulking water and gas pipe joints, dispensing with the old method of pouring molten lead into the caulking space. This method saves melting the lead, as well as the labor of one or more men usually required to keep the melting pot hot and taking the ladles of molten lead to open trenches. Actual tests show that the wool fibre lead produces better joints than in the poured work.

In the present state of wireless telegraphy, messages which as a rule are limited to 150 miles during the day time, can during the night be transmitted 2000 miles or over. The sun shining upon the earth, produces a resistance to the transmission of electrical waves, the same as a fog to the transmission of light. Thunderstorms likewise interfere with the transmission of wireless messages; therefore the summer months are not as good as the fall months. Wireless telegraphy is not yet an absolute commercial success.

PIPE LINES OF THE EASTERN OIL FIELDS.

The petroleum of the Appalachian oil fields is transported almost entirely by pipe-line companies.

In the pipe-line method of transportation the separate tanks at each well in the oil fields are connected by small pipe lines to a large tank at a general receiving station for the district. The station is situated, where possible, on land lower than the location of the producing wells, so that the oil in the tanks at the wells will flow by gravity to the main receiving station. Where this is not possible the oil is forced to the receiving station by small pumps run by gas or other engines in the field.

At the main receiving station are large and powerful pumps of the highest mechanical efficiency, run by triple-expansion engines, the steam being furnished from boilers of from 300 to 350 horsepower. These pumps draw the oil from the receiving tanks and force it into the main pipe lines under pressure of from 600 to

800 pounds to the square inch. The main pipe lines are usually 6 to 8 inches in diameter, laid in straight lines over hills and valleys from one pump station to another. The pump stations are located from 30 to 50 miles apart. The main trunk lines are capable of transporting from 20,000 to 30,000 barrels of oil in 24 hours.

REINFORCED CONCRETE BUILDING REGULATIONS OF THE CITY OF PHILADELPHIA.

The term "reinforced concrete" shall be understood to mean an approved concrete mixture reinforced by steel or iron of any shape, so that the steel or iron will take up all the tensional stresses and assist in the resistance to compression and shear.

Before a permit to erect any reinforced concrete structure is issued, complete specifications and drawings shall be filed with the Bureau of Building Inspection, showing all details of the construction, size and position of all reinforcing rods, stirrups, etc., and giving the composition and proportions of the concrete.

The execution of the work shall be performed by workmen under the direct supervision of a competent foreman or superintendent.

Reinforced concrete construction will be accepted for fireproof buildings of the first class if designed as hereinafter prescribed; provided that the aggregate for such concrete shall be clean, broken hard stone, or clean graded gravel, together with clean siliceous sand or fine-grained gravel. Should the concrete be used for flooring between rolled steel beams, clean furnace clinkers, entirely free of combustible matter, or suitable seasoned furnace slag may be used. When stone is used with sand gravel, it must be of a size to pass through a one inch ring, and 25 per cent of the whole not be more than one-half the maximum size; and provided, further, that the minimum thickness of concrete surrounding the reinforcing members of reinforced concrete beams and girders shall be two inches on the bottom and one and one-half inches on the sides of said beams and girders. The minimum thickness of concrete under slab rods shall be one inch. All reinforcement in columns to have a minimum protection of two inches of concrete.

All the requirements herein specified for the protection of steel and for fire-resisting purposes shall apply to reinforced concrete flooring between rolled steel beams, as well as to reinforced concrete beams and

to entire structures in reinforced concrete. Any concrete structure or the floor filling in same, reinforced or otherwise, which may be erected on a permanent centering of sheet metal, of metal lathing and curved bars or a metal centering of any other form, must be strong enough to carry its load without assistance from the centering, unless the concrete is so applied as to protect the centering as herein specified for metal reinforcement.

Exposed metal centering or exposed metal of any kind will not be considered a factor in the strength of any part of any concrete structure, and a plaster finish applied over the metal shall not be deemed sufficient protection unless applied of sufficient thickness and properly secured, as approved by the Chief of the Bureau of Building Inspection.

All concrete shall be mixed in a mechanical batch mixer to be approved by the Bureau of Building Inspection, except when limited quantities are required or when the condition of the work makes hand mixing preferable; hand mixing to be done only when approved by the Bureau of Building Inspection. In all mixing the material shall be measured for each batch.

When hand mixing is done under the aforesaid limitations, the cement and fine gravel or coarse sand shall be first thoroughly mixed dry and then made into a mortar by gradually adding the proper amount of water. The crushed stone or gravel shall be spread out to a depth not to exceed six inches, in a tight box or upon a proper floor, and be sprinkled with water as directed; the mortar is then to be evenly spread over the crushed stone, and the whole mass turned over a sufficient number of times to effect the thorough mixing of the ingredients.

All form and centering for concrete shall be built plumb and in a substantial manner, made tight so that no part of the concrete mixture will leak out through cracks or holes, or joints, and after completion shall be thoroughly cleaned, removing shavings, chips, pieces of wood and other material, and no debris of any kind shall be permitted to remain in the forms. All forms to be properly supported and braced in a manner to safely sustain the dead load and the load that may be imposed upon them during construction.

The reinforcing steel shall be accurately located in the forms and secured against displacement.

Concrete shall be placed immediately after mixing.

Whenever fresh concrete joins concrete that is set, or partially set, the surface of the old concrete shall be roughened, cleaned and spread with cement mortar, which mortar shall be mixed in proportion of one cement to two of sand.

Concrete shall not be mixed or deposited in freezing weather unless precautions are taken to avoid the use of material covered with ice or snow or that are in any other way unfit for use, and that further precautions are taken to prevent the concrete from freezing after being put in place. All forms under concrete so placed to remain until all evidences of frost are absent from the concrete and the natural hardening of the concrete has proceeded to the point of safety.

Concrete laid during hot weather shall be drenched with water twice daily, Sunday included, during the first week. The broken stone, if hot and dry, must be wet before going to the mixer.

The time at which props or shores may safely be removed from under floors and roofs will vary with the condition of the weather, but in no case should they be removed in less than two weeks; provided that column forms shall not be removed in less than four days; provided, further, that the centering from the bottom of slabs and sides of beams and girders may be removed after the concrete has set one week, provided that the floor has obtained sufficient hardness to sustain the dead weight of the said floor and that no load or weight shall be placed on any portion of the construction where the said centers have been removed.

The concrete for all girders, beams, slabs and columns shall be mixed in the proportions of one of cement, two of sand or fine gravel, and four of other aggregates as before provided. The concrete used in reinforced concrete steel construction must be what is usually known as a "wet" mixture. When the concrete is placed in water, it must be placed in a semi-dry state.

Only Portland cement shall be permitted in reinforced concrete constructed buildings. All cement shall be tested in carload lots when so delivered, or in quantities equal to same, and report filed with the Bureau of Building Inspection before using it in the work. Cement failing to meet the requirements of the accelerated test will be rejected.

Soundless, Accelerated Test. — Pats of neat cement will be allowed to harden twenty-four hours in moist air, and then be submitted to the accelerated test as follows: A

pat is exposed in any convenient way in an atmosphere of steam, above boiling water, in a loosely closed vessel, for three hours, after which, before the pat cools, it is placed in the boiling water for five additional hours.

To pass the accelerated test satisfactorily, the pats shall remain firm and hard, and show no signs of cracking, distortion or disintegration.

Such cements when tested shall have a minimum tensile strength as follows: Neat cement shall, after one day in moist air, develop a tensile strength of at least 150 pounds per square inch; and after one day in air and six days in water shall develop a tensile strength of at least 500 pounds per square inch; and after one day in air and twenty-seven days in water shall develop a tensile strength of at least 600 pounds per square inch. Cement and sand tests composed of one part of cement and three parts of crushed quartz shall, after one day in air and six days in water, develop a tensile strength of at least 175 pounds per square inch, and after one day in air and twenty-seven days in water shall develop a tensile strength of at least 240 pounds per square inch. These and other tests as to fineness, set, etc., made in accordance with the standard method prescribed by the American Society of Civil Engineers, may, from time to time, be required by the Bureau of Building Inspection.

Walls.—Reinforced concrete may be used in place of brick and stone walls, in which case the thickness may be two-thirds of that required for brick walls, as shown in the Schedule, Section 18 of the Act of Assembly No. 123 of the Commonwealth of Pennsylvania, approved June 5, 1901, provided the unit stresses as set forth in these regulations are not exceeded.

Concrete walls in such cases must be reinforced in both directions in a manner to meet the approval of the Chief of the Bureau of Building Inspection.

Steel.—All reinforcements used in reinforced concrete shall be of standard grade of structural steel or iron of either grade to meet the "Manufacturers' Standard Specifications," revised February 3, 1903.

Reinforced concrete slabs, beams and girders shall be designed in accordance with the following assumptions and requirements:

(a) The common theory of flexure to be applied to all beams and members resisting bending.

(b) The adhesion between the concrete and the steel is sufficient

to make the two materials act together.

(c) The design shall be based on the assumption of a load four times as great as the total load (ordinary dead load plus ordinary live load).

(d) The steel to take all the tensile stresses.

(e) The stress strain curve of concrete in compression is a straight line.

(f) The ratio of the moduli of elasticity of concrete to steel:

Stone or gravel concrete..	1 to 12
Slag concrete	1 to 15
Cinder concrete	1 to 30

The allowable unit transverse stress upon concrete in compression:

The allowable unit transverse stress in tension:

The allowable unit shearing strength upon concrete:

The allowable units adhesive strength of concrete:

The allowable unit stresses upon concrete in direct compression in columns:

The allowable unit stress upon hoop columns composed of stone or gravel concrete shall not be over 1,000 pounds per square inch, figuring the net area of the circle within the hooping. The percentage of longitudinal rods and the spacing of the hoops to be such as to permit the concrete to safely develop the above unit stress with a factor of safety of four.

When steel or iron is in the compression sides of beams the proportion of stress taken by the steel or iron shall be in the ratio of modulus of elasticity of the steel or iron to the modulus of elasticity of the concrete; provided that the rods are well tied with stirrups connecting with the lower rods of the beams; provided, further, that when rods are used in compression the approval of the Chief of the Bureau of Building Inspection must be obtained.

In the design of structures involving reinforced concrete beams and girders, as well as slabs, the beams and girders shall be treated as T beams, with a portion of the slab acting as flange in each case. The portion of the slab that may be used to take compression shall be dependent upon the horizontal shearing stress that may exist in the beam, and in no case shall the slab portion exceed twenty (20) times the thickness of the slab.

All reinforced concrete T beams must be reinforced against the shearing stress along the plane of junction of the rib and the flange, using stirrups throughout the

length of the beam. Where reinforced concrete girders carry reinforced concrete beams, the portion of the floor slab acting as flange to the girder must be reinforced with bars near the top, at right angles to the girder, to enable it to transmit local loads directly to the girder and not through the beams, thus avoiding an integration of compressive stresses due to simultaneous action as floor slab and girder flange.

In the execution of work in the field work must be so carried on that the ribs of all girders and beams shall be monolithic with the floor slabs.

In all reinforced concrete structures special care must be taken with the design of joints to provide against local stresses and secondary stresses due to the continuity of the structures.

Shrinkage and thermal stresses shall be provided for by the introduction of steel.

In the determination of bending moments due to the external forces, beams and girders shall be considered as simply supported at the ends, no allowance being made for continuous construction over supports. Floor slabs, when constructed continuously, and when provided with reinforcement at top of slab over the supports, may be treated as continuous beams, the bending moment for uniformly distributed loads being taken at not less than WL.10; in case of square floor slabs which are reinforced in both directions and supported on all sides, the bending moment may be taken at WL.20; provided that in floor slabs in juxtaposition to the walls of the building bending moment shall be considered as WL.8, when reinforced in one direction, and if the floor slab is square and reinforced in both directions, the bending moment shall be taken as WL.16.

When the shearing stresses developed in any part of a reinforced concrete building exceed under the multiplied loads the shearing strength as fixed in this section, a sufficient amount of steel shall be introduced in such a position that the deficiency in the resistance to shear is overcome.

When the safe limit of adhesion between the concrete and steel is exceeded, provision must be made for transmitting the strength of the steel to the concrete.

Reinforced concrete may be used for columns in which the ratio of the length to least side or diameter does not exceed fifteen (15). If more than 15 diameters, the allow-

able stress shall be decreased proportionally. Reinforcing rods that are introduced for lateral stresses must be tied together at intervals of not more than the least side or diameter of the columns.

Longitudinal reinforcing rods will not be considered as taking any direct compression.

The contractor must be prepared to make load tests in any portion of a reinforced concrete building within a reasonable time after erection, and as often as may be required by the Chief of the Bureau of Building Inspection. The tests must show that the construction will sustain a load equal to twice the calculated live load without signs of cracks.

Systems of construction differing from the standard already approved and tested may be required to pass a load, fire and water test, as present in Section 2 of the Act of Assembly No. 236 of the Commonwealth of Pennsylvania, approved April 25, 1903.

The Chief of the Bureau of Building Inspection may, from time to time, issue such modifications to these regulations as may be found necessary to conform to modern practice.

Approved, 10-8-'07.

HENRY CLAY,

Director of the Department of Public Safety.

EDWIN CLARK,

Chief, Bureau of Building Inspection, Philadelphia.

Come to the Chicago Cement Products Exhibition Dec. 17 to 21st, where up-to-date Cement Machinery and Products will be displayed.

The Blanc Stainless Cement Co., J. Maxwell Carrere, Gen. Manager, Works Allerton, Pa., commenced operation on Nov. 12th. The plant is a small one, the Kiln and Grinding room being only 22x28, feet square. The inventor claims the Cement is stronger than Portland Cement. We believe the White Stainless Cement is more of the nature of Natural Cement than a Portland. The product is designed for high class work only.

Enter your Cement Machinery and Products at the great Chicago Cement Show, Dec. 17 to 21st, do so at once.

Write to L. L. Fest, New Southern Hotel, for exhibition space at the Chicago Cement Show.

REINFORCED CONCRETE BOAT.

Reinforced concrete boat construction is not new. One of the first specimens of this class of construction was a row boat exhibited at Paris in 1855. It was a metal skeleton frame covered with woven wire and plastered over with cement mortar. This boat is still in use.

We illustrate a reinforced concrete lighter or barge of 150 tons burden, which is used for transporting freight to and from vessels

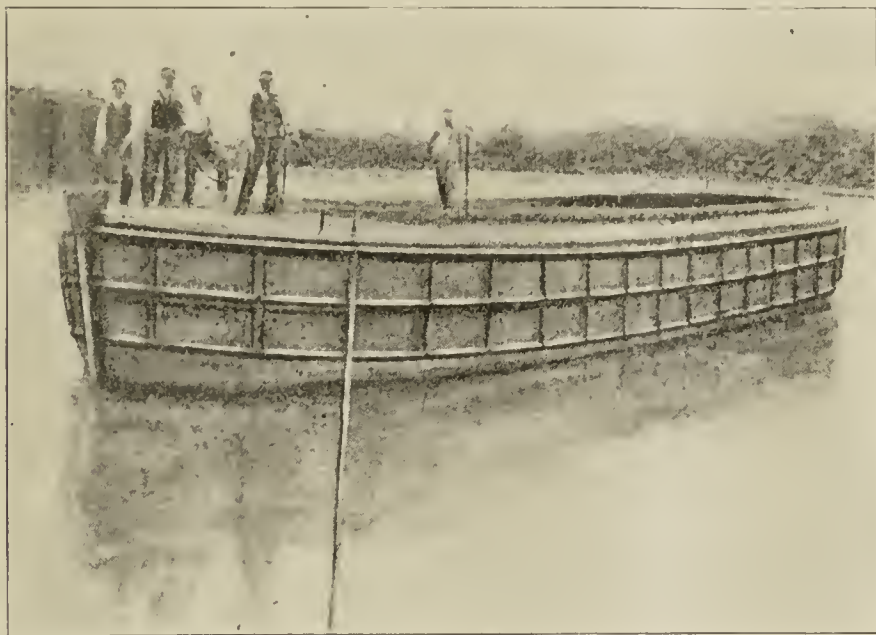
EFFECT OF MOISTURE ON WOOD.

The effect of water in softening organic tissue, as in wetting a piece of paper or a sponge, is well known, and so is the stiffening effect of drying. The same law applies to wood. By different methods of seasoning two pieces of the same stick may be given very different degrees of strength.

Wood in its green state contains moisture in the pores of the cells, like honey in a comb, and also in the substance of the cell walls. As

materials they use, and for this reason they are quite as much interested in knowing how timbers are affected by moisture as they are in knowing how they are weakened by knots, checks, cross-grain and other defects. It is clear that where timbers are certain to be weakened by excessive moisture they will have to be used in larger sizes for safety. So far, engineers of timber tests, while showing that small pieces gained greatly in strength, do not advise counting on the same results in the seasoning of large timbers, owing to the fact that the large timbers usually found in the market have defects which are sure to counterbalance the gain from seasoning.

The Forest Service has just issued a publication entitled "The Strength of Wood as Influenced by Moisture," in which are shown the strength of representative woods in all the degrees of moisture from the green state to absolute dryness, and the effects of resoaking. This publication will be sent free upon application to the Forest Service, U. S. Department of Agriculture, Washington, D. C.



One Hundred and Fifty Ton Reinforced Concrete Boat.

moorde in the open roadstead off the port of Civita, Vicchia, 38 miles northwest of Rome, Italy. This craft was built by the firm of C. Gabellini of Rome, who makes a specialty of cement and steel ship building.

Some of these cement boats have been in constant use since 1896, and still are in good condition.

Cement pontoons are used to bridge the River Po in Italy, which is described in F. Von Empergens Handbuch for Eisenbeton Bau. The craft we illustrate is a skeleton steel frame covered inside and outside with a wire mesh fabric, plastered with Portland cement mortar, finished on the outside with neat cement trowelled down smooth, with wooden side floats. The sides of the vessels are strengthened by concrete ribs, which project beyond the face of the hull, as shown in the illustration.

Cement Products Exhibition at the Coliseum, Chicago, Dec. 17 to 21st, 1907. This building encloses the largest exhibition space in the West. For space apply to L. L. Fest, Manager, New Southern Hotel, Chicago.

seasoning begins the moisture in the pores is first evaporated. This lessens the weight of the wood, but does not affect its strength. It is not until the moisture in the substance of the cell walls is drawn upon that the strength of the wood begins to increase. Scientifically, this point is known as the "fiber-saturation point." From this condition to that of absolute dryness the gain in the strength of wood is somewhat remarkable. In the case of spruce the strength is multiplied four times; indeed, in spruce, in small sizes, thoroughly dried in an oven, is as strong, weight for weight, as steel. Even after the re-absorption of moisture, when the wood is again exposed to the air the strength of the sticks is still from 50 to 150 per cent. greater than when it is green. When, in drying, the fiber-saturation point is passed, the strength of wood increases as drying progresses, in accordance with a definite law, and this law can be used to calculate from the strength of a stick at one degree of moisture what its strength will be at any other degree.

Manufacturers, engineers and builders need to know not only the strength, but the weakness of the

IRON-ORE RESERVES OF THE UNITED STATES.

About two years ago, in response to a request from the Swedish parliament, an eminent Swedish geologist prepared a report on the iron reserves of the world.

The character of the report in the form in which it reached the American public is fairly indicated in the following extracts:

"It will surprise a great many to learn that we are likely to run short of iron inside of a single century if we keep up the present rate of consumption. As a matter of fact we are more likely to increase the consumption than we are to reduce it. The world has only ten billion tons of iron ore available. Of these Germany has twice as many tons as the United States. Russia and France have each 400,000,000 tons more than this country. . . . Assuming, therefore, as true the claim of geological science that the extent of the workable iron-ore beds is known to within a margin of possible error not exceeding 5 per cent, the Swedish report, which is based upon the most authoritative information, has naturally attracted world-wide attention."

Edwin C. Eckel, of the United States Geological Survey, makes the following statements concerning the Swedish report and the subject in general. In an advance chap-

ter from "Mineral Resources of the United States, Calendar Year 1906," on iron ores, pig iron and steel, shows that our iron ore reserves far exceed the Swedish estimate; the Lake Superior district alone is estimated to contain up to two billion tons.

This supply is being drawn on to meet a constantly increasing annual demand, and before 1915 the district will probably be called upon to ship over 50,000,000 tons of ore a year. At such a rate the Lake Superior ores can hardly be expected to last beyond the year 1950, and it is equally clear that long before that date the value of good workable deposits of iron ore, both in this field and elsewhere in the United States, will have increased immensely. It is probable that careful exploratory work will develop magnetic iron ores in New York, New Jersey and Pennsylvania in quantities far in excess of anything usually considered possible in those states. Here close estimates are impossible.

With regard to the southern ores the case is very different—the quantity of ore available gives a fairly secure basis for tonnage estimate. It is safe, therefore, to submit the following figures as representing minimum values for the workable iron-ore reserves above the 1,000-foot level in certain Southern states:

	Red ore. Long tons.	Brown ore. Long tons.
Alabama	1,000,000,000	75,000,000
Georgia	200,000,000	125,000,000
Tennessee ...	600,000,000	225,000,000
Virginia	50,000,000	300,000,000
Total	1,850,000,000	725,000,000

This gives a total estimated reserve for the red and brown ores of the four states noted of over 2,500,000,000 tons. If to this we add the ores occurring at deeper levels in the states named, and also the red and brown ores of Maryland, West Virginia and Kentucky, and the magnetic ores of the other Southern states, it is probably fair to assume that the total southern ore reserve will amount to very nearly 10,000,000,000 tons, or five times that credited to the Lake Superior region. Much of this ore is of course unworkable at the present day.

To sum up the matter: In place of the 1,100,000,000 tons credited by the Swedish geologist, it is probably safe to say that the United States has from ten to twenty times that reserve of iron ore.

Assuming that the demand for iron ore during the present century may range from 50,000,000 to 100,000,000 tons per year, the Lake Superior district would last for from twenty-five to fifty years more, if it supplied the United States. But counting on the known reserves elsewhere in the United States, the ore will last for a much longer period, though of course it must necessarily show a gradual but steady increase in value and in cost of mining, along with an equally steady decrease in grade.

Our iron ore output in 1906 was 47,749,728 long tons, valued at \$100,597,106. We imported during the same period 1,060,390 long tons, valued at \$2,967,434.

EDISON CAST CONCRETE HOUSES.

The announcement that Thomas A. Edison had perfected a system of casting a complete dwelling house in one single continuous operation has awakened widespread interest and a demand for definite information on this subject throughout the country. While a full sized house has not yet been constructed, a complete house on a scale of three inches to the foot has been completed, perfect in every detail, and is now to be seen in the Edison laboratory. Its construction was carried out on the same practical lines that will obtain in a full sized building, excepting only that provisions must be made for the perfect handling and mixing of large quantities of materials without intermission, to fill the moulds which give shape and form to the structure to be cast.

The Edison system of constructing cast concrete houses consists in assembling cast iron molds or forms made of three-quarter inch cast iron, accurately fitted and planned, nickel plated and polished. The first cost of such forms being about \$25,000. These forms are assembled and held in place by dowel pins and trusses. When the entire mold is in place concrete is pumped into the areas between the forms at the rate of 175 cubic yards per day. The concrete must be of such a consistency as to spread and fill the ornamental details, which are very artistic. The casting of these ornamental patterns must be very slow in order to displace the air, otherwise there will be air bubble holes in the face of the work, especially in the under cut work. The mix in the concrete is to be composed of one part of finely ground cement high in lime, three of sand and five crushed stone. This mix is designed to give the best results in reproducing the minute details in the ornamental portions of the

molds. Wire reinforcements will be placed in the members that will be subjected to stress. Bath tubs and other plumbing facilities will be cast in place, while ducts or openings for pipes and conduits will be left in the walls and floors through which electric wiring and lead pipes can be drawn. Doors, window sash and strips in the floor for fastening carpets will be the only wood used in the building.

The molds for the first house are designed to produce a dwelling in the style of Francis I., quite elaborate and almost prohibitive in natural stone. All interior decorations will be complete when the forms are removed, including elaborate chimney pieces and mantles. The wall will be 12 to 10 and 6 inches thick. The roof will imitate clay tile. The forms are designed to be used over and over again and can be used for casting thousands of houses. After seven days the forms or molds can be removed and set up again for casting, house after house. The wear and tear for each house on the molds is estimated at \$50. The house shown was designed by Architects Manning and Macnelle, the cut on front page is from the Scientific American, while the matter from the same source has been recast.

India has seventy-five million acres of rice under cultivation. Rice is the world's leading cereal. In Philippines Islands one laborer will produce 1,500 pounds of unhusked rice. While one laborer in the United States with modern machinery will produce 160,000 pounds.

COMMON BRICK AND SEWER PIPE OUTPUT.

Brick for years has been displacing wood in building construction. Brick in turn is being displaced by concrete construction, yet the brick industry is one of great magnitude and will always continue to exist and show an increased output in the face of a decline in price. In 1906 the output of common brick was 10,027,039,000, valued at \$61,300,696. Paving brick are likewise being displaced by cement street paving, which is gradually and certainly coming into use. The vitrified paving output for 1906 was valued at \$7,857,768, at the rate of \$10.45 per thousand. The clay sewer pipe output for 1906 is \$11,114,967. Here again cement is making vast inroads as well as in clay drain tile, the output being \$4,643,898 in value.

UNIVERSAL BROCKETTS FOR SCAFFOLDING.

European building contractors are compelled to study the greatest possible economy in the use of lumber for falsework, on account of

These brocketts can be used over and over again. They are sold in Berlin, Germany, at \$36.00 per hundred, at Paris and Vienna \$38.00 per hundred.

Four of these brocketts are calcu-

the wooden supports have been used five times. The wear and tear will amount to fully 20 per cent, while the brocketts will be practically as good as ever.

These brocketts are used by the leading concrete building contractors in Europe, who speak well of

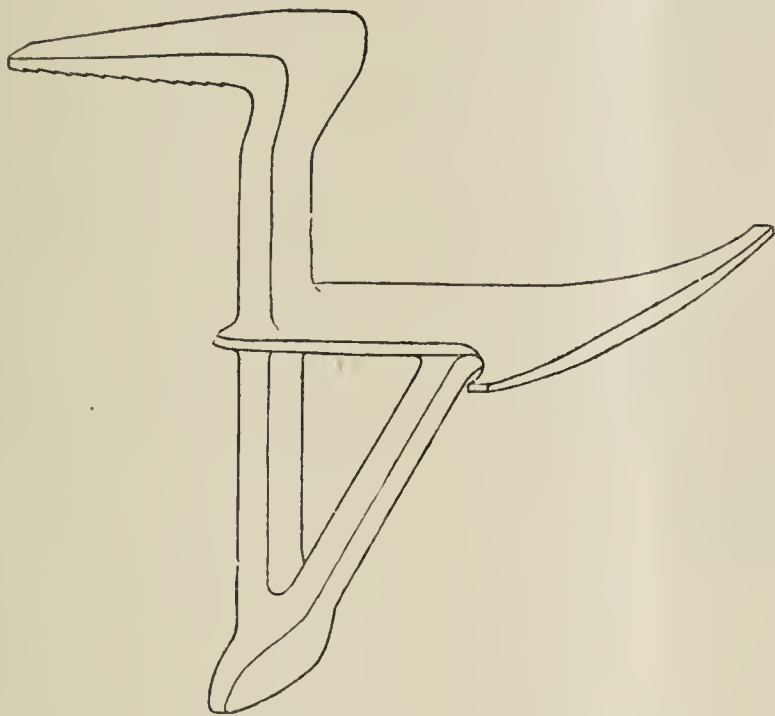


Fig. 1—Mineral Scaffold Bracket.

high cost. Even in this country forms for falsework in concrete construction will average from 15 to 35 per cent of the contract price for the work in hand. A device which has come into extensive use in masonry construction throughout continental Europe for saving

lated to carry a deal load of 5,720 pounds.

The economy in the use of each brockett used five times as compared with the use of wooden supports used five times, cost of each

them. We believe this device could be introduced with advantage in this country.

Cement Products Exhibition at the Coliseum, Chicago, Dec. 17 to 21st, 1907. This building encloses

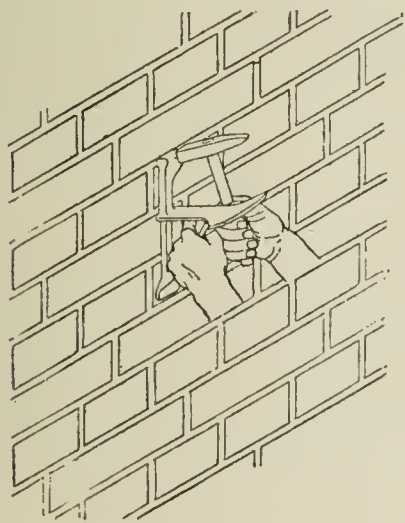


Fig. 2—Placing the Bracket.

lumber is known as Der Universal Ruster, or Universal Scaffold Brackett, shown in Fig. 1. The Wedge shaped projection is driven into the Wall at the mortar joint. Several of these brocketts are seated into the wall along the same mortar joint to carry a piece of timber upon which the floor planks are laid. All is shown in Figs. 4 and 5.



Fig. 4—Bracketts Supporting floor.

wooden support including transportation and setting and removing same 11 cents for support against 1 1-2 cents for each brocketts, after

the largest exhibition space in the West. For space apply to L. L. Fest, Manager, New Southern Hotel, Chicago.

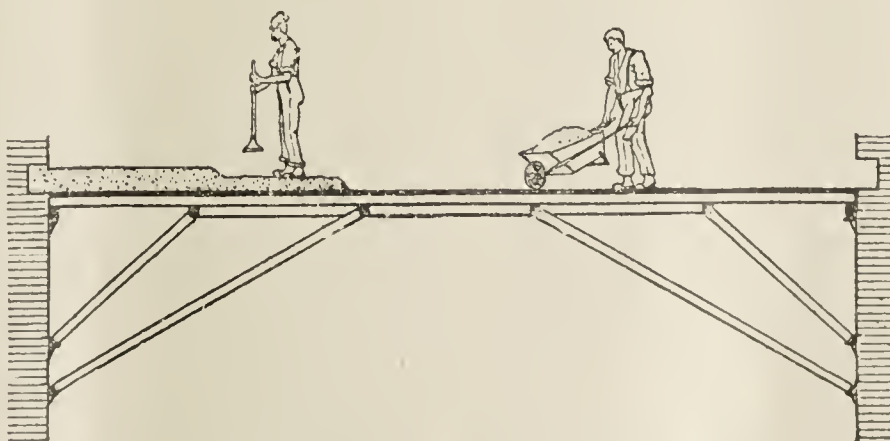


Fig. 5—Bracketts Supporting Fake Work.



O. U. Miracle of the Miracle Pressed Stone Company, reproduced from the Minneapolis Daily News. Mr. Miracle is at the head of one of the largest, most reliable and enterprising cement machinery companies in the world. The Miracle machinery is found in every civilized country on the globe. There is no tool or device required by the cement contractor that the Miracle Pressed Stone Company cannot supply, to all of which we can testify.

INCORPORATED.

John R. Markley, 406 West Lake St., Chicago, Illinois, is promoting a Portland Cement plant to be located at St. Stephens, Washington Co., Alabama. Mr. Markley is a member of the firm of Markley & Miller, hard wood lumber dealers at above Chicago address. The plant is to be incorporated for \$2,000,000.

The Sandusky Portland Cement Co., of Sandusky, O., manufacturers of Medusa Water-proof Compound

report that that material was used in the following work:

By the Atchison, Topeka & Santa Fe Ry. Co., in the concrete depot at Las Animas, Colo. and by the same railroad in their tie and timber treating plants at Albuquerque. In the roof of the North Chicago Hardware Co., in a concrete reservoir for the Chicago Junction Ry. Co. and Chicago & Northwestern Ry. Co., track elevation at Chicago.

The compound has also been recommended by the engineer in charge for the New Phipps Nata-

torium being constructed in Pittsburgh. This recommendation having been made after severe tests proved satisfactory.

The Bonner Portland Cement Co. of Bonner Springs, Kansas, is reported to have ordered a portion of its machinery from France.

The Fidelity Portland Cement Co. of Cherryvale, Kansas, has been organized. Capital stock \$2,000,000. The plant is to be located on the west bank of Drum creek, near Cherryvale, on the Watson and McCorkhill farms, forty rods south of the Santa Fe tracks.

The Southwestern Cement Plaster Co. has been incorporated with a capital stock of \$350,000 by E. E. Cressler, Chas. Glyckherr and others. Machinery will be purchased and plant erected at Okun, Oklahoma. The Frisco railway is building a switch from its main line to the building site.

The Burt Portland Cement Co. was temporarily shut down for repairs during the first week in November, and the installation of a water purifying system for its boilers.

Several of the cement mills in the Lehigh region are reducing their output, lowering wages and laying off men. The Dexter has shut down two of its kilns.

The Dixie Portland Cement Plant at South Pittsburg began grinding raw material November 10th. As soon as sufficient raw pulverized material is on hand the kilns will be brought into operation.

The Ohio Valley Concrete and Building Co., of Parkersburg, W. Va., has been incorporated, with a capital stock of \$25,000, to manufacture all kinds of building blocks, sewerage and other tile and all products of sand and cement. H. V. Reese, C. T. Parks, F. A. Parrish, and others, incorporators.

Write to L. L. Fest, New Southern Hotel, for exhibition space at the Chicago Cement Show.

The Cement Products' Manufacturing Co., of Homestead, Blaine Co., Okla., has been incorporated, capital stock \$50,000, for manufacturing purposes. Building will be erected at a cost of \$50,000; \$20,000 worth of machinery will be purchased.

The Independence Tile Co., of Independence, Buchanan Co., Iowa, to manufacture farm drain tile. The present capacity of the plant is 4,000 tile per day.

The Gainer Engineering Co. has removed its headquarters from Independence to Humboldt, Kansas. The Gainer have contracts to erect the Monarch Portland Cement Company's plant at Humboldt, and the German Portland Cement Plant at Chanute, Kansas.

Iron and steel produced in the United States in 1907, and manufactures thereof is estimated at \$740,314,557 by the United States Department of Commerce and Labor, of which \$181,530,871 is calculated for export. The money in circulation in this country at present is \$2,914,342,256, divided as follows: Gold, \$698,762,929; silver, \$203,450,494; gold certificates, \$602,973,499; silver certificates, \$470,375,262. United States notes outstanding, \$342,713,692; national bank notes outstanding, \$590,000,835; miscellaneous currency, \$5,975,545; deposits in National banks, \$4,322,880,141; deposits in savings banks, \$3,399,544,601.

The Northwestern Concrete Paving Co. of Portland, Me., has been incorporated with a capital stock of \$50,000 by L. A. Goudy, Carrol Brown, and a number of others. L. A. Goudy, is president.

The Alpha Portland Cement is to construct a waterproof plant on the Pennsylvania side of the Delaware river near Foul Rift, a canal 50 feet wide and three miles long will be built to develop a strong current to operate water wheels, the power will drive electric generators to operate its three mills.

Come to the Chicago Cement Products Exhibition Dec. 17 to 21st, where up-to-date Cement Machinery and Products will be displayed.

MERCHANDISE SHIPPED TO ALASKA.

During nine months ending September, 1907, the following shipment of merchandise was made to Alaska: Cement from the United States 837 bbls. valued at \$2,647; foreign cement, 1,688 bbls., valued at \$5,345; whisky, wines and malt liquors, valued at \$543,226; soap valued at \$23,473; tobacco, \$473,772.

Cement Products Exhibition at the Coliseum, Chicago, Dec. 17 to 21st, 1907. This building encloses the largest exhibition space in the West. For space apply to L. L. Fest, Manager, New Southern Hotel, Chicago.

The Standard Portland Cement Co., shut down its plant on Nov. 7th, on account of a shortage of cars on the Southern Pacific Railway. The cement company will build an electric line from its works to the Napa river, a distance of two miles, over which its product will be transported to barges and carried to San Francisco and other bay points. Many of its employees are to be transferred to the company's new works at Santa Cruz.

THE SUPERIOR PORTLAND CEMENT CO.

The plant of the Superior Cement Co. is located at Superior, Lawrence County, Ohio, on the Detroit, Toledo & Ironton Ry., on a 900-acre tract of land conveying first-class raw cement material, and coal deposits. The capital stock is \$525,000, fully paid. The raw cement materials are transported down grade from the quarries to the mill in which the material is handled by gravity throughout from the crushers to the storage bins. The plant is equipped with Mitchell cross-over dumps to No. 9 and No. 5 Gates rock crushers, and for the shale a No. 5 American clay dry pan. From these the limestone and shale are separately conveyed to the circular bins, the limestone bin 20 ft. in diameter and the shale 15 ft. and each 45 ft. high. Automatic feeders convey the limestone to two limestone dryers and one shale dryer 5 ft. in diameter and 60 ft. long. Three Kominuters reduce the materials, from which it is further reduced in 6 Smidth Tube Mills, and thence to the Pulverized raw mixture bins, from which it is fed into rotary kilns 125 ft. long,

7 ft. 6 inches diameter. The Clinker afterwards passes through four Masser Clinker Coolers into four pot crushers, after which it is ground in 10 Griffin mills and finished in F. L. Smidth mills. The power equipment was installed by the Atlas Engine Works of Indianapolis, consisting of a battery of six 400 H. P. water tube boilers, two 700 H. P. Atlas engines for rope drive and two direct connected 400 H. P. Atlas engines, the other elevated machinery being supplied by the Jeffrey Mfr. Co. of Columbus, O. The Fuller Lehigh Co. mills do the coal grinding. The plant is modern throughout.

The office of the company is at Charleston, W. Va.

The officers of the company are as follows: Justus Collins, Pres., Charleston; M. L. Sternberger, Vice-Pres., Jackson, O.; J. A. Latrin, Sec. and Treas., Charleston, W. Va.; J. B. John, Supt., Superior, O.; Jno. Black, Chemist, Superior, O.

Albert Vaughn has secured a judgment of \$5,000, against the Glen Falls Portland Cement Co., for the loss of an arm in the company's mill. The rule of liability being that when an employee is acting under the order of someone in authority over him and receives an injury, the company is liable; but not when such an injury was received while acting under the request of a fellow employee, providing the machinery was in fair state of repair.

Come to the Chicago Cement Products Exhibition Dec. 17 to 21st, where up-to-date Cement Machinery and Products will be displayed.

ATLANTIC CEMENT CO., NEW YORK.

A meeting of the creditors of the Atlantic Cement Co., of 439 Fifth avenue, New York, against which a petition in bankruptcy was filed on September 27, was held yesterday at the office of Peter B. Olney, referee in bankruptcy, at 68 William street; many claims were proved and three trustees were elected, namely, Wm. H. Barnes, Benj. F. Elgar and Benj. F. Stradley, their bonds being fixed at \$100,000. Schedules were filed showing liabilities \$203,906, with thirty-five additional claims, amounts not given, as they are disputed, and nominal assets \$343,896, consisting of stock, \$30,493; cash, \$3,527; outstanding

accounts, \$165,209; suspense accounts, \$46,891; loan accounts, \$82,193, of which \$70,000 is a loan to the Kohl-Hepp Brick Co.; notes, \$810; machinery, \$2,543; sheds, \$1,563; lease of yard at 201st street and Harlem River, \$10,000; assigned as collateral for loans, horses and wagons, \$667. The New York City Railway Company owes the company \$18,865. Among the creditors are the Broadway Trust Co., \$7,500, secured; Bath Portland Cement Co., \$29,128; Kohl-Hepp Brick Co., \$20,503; Rose Brick Co., \$20,255; Northampton Cement Co., Stockton, Pa., \$12,297; Alpha Portland Cement Co., \$11,857; W. H. Barnes & Co., \$11,180; Hiram Snyder & Co., \$9,066; John J. King, \$8,896 and Wm. A. Hennessey & Co., \$5,238.

William H. Ford, for several years sales manager of the Kosmos Portland Cement Co., with offices in the Paul Jones building, Louisville, Ky., has been elected vice-president of the William G. Hartman Cement Co., of Philadelphia, and first vice-president and general manager of the William G. Hartman Cement Co., of Canada, with general sales offices in Montreal. The position is one of the most important with the company and carries with it a salary of \$10,000 a year. Mr. Ford first entered the cement business in 1903 as salesman for the Carolina Portland Cement Co., of Charleston, S. C., where he was born.

The Blount Mountain Portland Cement Co. of West Virginia. Capital \$3,000,000, propose to build a plant at Blount Mountain, north of Blount Springs, Blount County, Alabama, on the line of the Louisville & Nashville Railway. The lime rock found in this region is known as Mississippian (lower carboniferous) limestone and carries from 92.61 to 99.16 carbonate of lime, less than 2 per cent magnesia and up to 3.82 silica. The entire county is underlaid with coal. The incorporators of the company are G. A. Schneebeli, R. E. Schneebeli and E. Schneebeli, all Nazareter, Pa., H. M. Savers of New York, and Geo. F. Coffin of Easton, Pa.

Come to the Chicago Cement Products Exhibition Dec. 17 to 21st, where up-to-date Cement Machinery and Products will be displayed.

DRAGON PORTLAND CEMENT.

The Lawrence Cement Company, No. 1 Broadway, N. Y., has issued a neat book of 126 pages which gives much useful information relating to use of Portland cement. Beginning with the early history of cement in England and the United States, with a short description of the modern method of cement manufacture from the crude raw material, which is followed step by step through to the various machines and appliances, to the finished product. Followed by descriptions of standard tests for soundness tensile and compressive strength. Under the head of General Information, much practical information is given that will assist the cement user in obtaining the best results from various kinds of aggregates rules for mixing and tamping concrete. The construction of floors and pavement, indoor and outdoor work. Finishing, plain and water tight work, being minutely described; other useful information is given relating to the weight of materials entering into concrete. A list of testimonials from railways, government engineers, contractors and numerous users of Dragon Portland Cement, testifying to its uniform good properties from almost every section of the country, together with illustrations of prominent buildings and bridges in which this brand of cement has been employed.

Statistics of building operations in forty-nine leading cities of the United States for 1905 and 1906 show that 185,806 buildings were erected in these cities in 1905, valued at \$644,620,873, against 180,574 valued at \$678,710,969, being a net gain of \$34,090,096. In thirty-five of the leading cities 37,066 building permits were issued for brick and other refractory material valued at \$415,438,100 against 52,814 permits for wooden buildings valued at \$107,408,291.

The Allentown Portland Cement Co. of Allentown, Pa., will erect a plant at West Coply, Pa. The Fuller Engineering Co. have the contract for erecting the mill. Mr. Chas. A. Matcham is President of the Engineering Co. J. W. Fuller, General Mgr. and H. C. Barnhurst, Mechanical Engineer.

Write to L. L. Fest, New Southern Hotel, for exhibition space at the Chicago Cement Show.

AERIAL NAVIGATION.

The navigation of the air is now being developed in the European armies by special corps of military engineers and officers of the line.

Air ships now sail over the cities of Paris and Berlin quite frequently, answering to the helm perfectly. One airship made a trip from a military post to and from Paris, covering a distance of 34 miles in 1 hour and 20 minutes. Both the French and German governments have established schools of instructions in ballooning. Both countries are building fleets of air ships for use in military operations. The French government has laid down plans for building these balloons in series of five, the first five being well under way. These balloons are all filled with hydrogen gas when in flight. Up to the present time this gas has been made on the ground or furnished by steel cylinders under a compression of 135 atmospheres or 2,025 pounds to the square inch. Six thousand cubic feet of gas including truck cylinders and apparatus weigh about 7,000 pounds.

A new gas producing compound is used known as Hydrolith (Calcium Hydride CaH_2). One hundred pounds of this substance will produce 1,600 cubic feet of hydrogen gas when brought in contact with water. This will greatly facilitate ballooning inasmuch as Hydrolith can be carried as part of the load as well as be transported on land as an inert substance, while the compressed gas in steel cylinders has been looked upon as a source of danger by the military authorities.

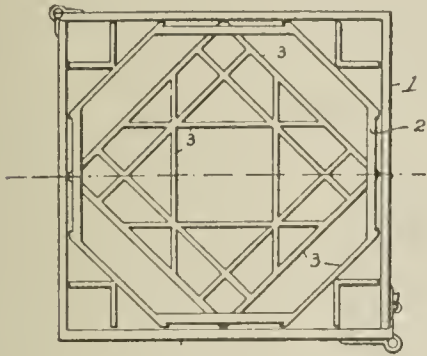
Write to L. L. Fest, New Southern Hotel, for exhibition space at the Chicago Cement Show.

The Louisville Cement Co., through its representative, H. W. Palmer, is reported to have secured options on land carrying lime stone and shale located near Tula, state of Hidalgo, Mexico, about 50 miles north of the City of Mexico. The Louisville Cement company has been securing parcels of land in the vicinity of Tula for more than a year with the view of building a cement plant on their holdings.

Enter your Cement Machinery and Products at the great Chicago Cement Show, Dec. 17 to 21st. Do so at once.

U. S. PATENTS RELATING TO CE- MENT AND CONCRETE.

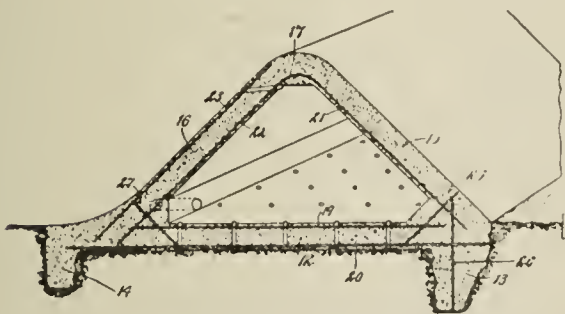
868,261. Process of Making Tiles. Constantinos H. Geanakopulos, Reading, Pa. Filed May 4, 1907. Serial No. 371,893.



No. 1.

The process of making tile sections of varied colors, consisting of placing a removable form comprising a series of joined partitions in a mold, partially filling the spaces between said partitions with a mixture of high grade colored cement and sand, removing the form from the mold filling the mold with a mixture of sand and cement of inferior quality, subjecting the whole to severe pressure, applying to the face of said section a coating of specially prepared dressing composed of beeswax, linseed oil and alcohol and drying by air.

870,934. Dam. Howard L. Curn, Boston, Mass. Filed July 19, 1905. Serial No. 270,369.



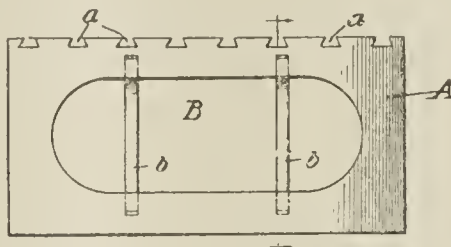
No. 2.

3. A dam consisting of a deck slab of concrete having its lower edge locked into the foundation bed so as to prevent the passage of water thereunder, its upper edge supported by a suitable continuous strut transmitting the pressures to the foundation or bed, said deck slab being so reinforced by rods running vertically as to resist all bending stresses due to the superimposed load of water without the assistance of any intermediate supports between the bottom and top edges thereof, said strut being of a strength and standing at an angle

to resist water pressure against the deck without internal bracing.

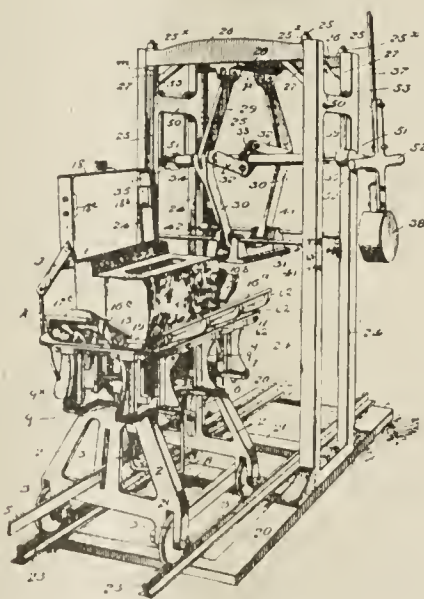
4. A dam consisting of a base, an inclined deck and an oppositely inclined apron, both rising from the said base and meeting at the crest to form a self-supporting structure, the said deck and apron being constructed of concrete or other suitable material, and forming an unobstructed interior.

869,770. Building-Block. William W. Birnstock, York, Pa., assignor of one-half to Matthew G. Collins, York, Pa. Filed Oct. 31, 1906. Serial No. 341,419.



No. 3.

1. A hollow building block formed with continuous side and end walls and having a single central elongated opening between the side and end walls extending vertically through the block, and a pair of spaced reinforcing metal struts extending across the opening, and having their opposite ends embedded in the front and rear parallel walls of the block, said struts being arranged midway of the vertical height of the block to form handles accessible from either open side of the block, and the struts being parallel with each other, and at equal



No. 4.

distances from the ends of the block for convenience in lifting the latter.

- 869,271. Machine for Making Building-Blocks. Edward H. Somers, Urbana, Ill. Filed June 22, 1906. Serial No. 322,887.

1. In a machine for making build-

ing blocks, the combination of a support; a mold-box mounted thereon free to move relatively thereto; a hopper mounted on said mold-box free to move to and from operative position thereon; and mechanism by which the movement of said mold-box relatively to its said support moves said hopper to and from operative position.

6. In a machine for making building blocks, the combination with suitable supporting members, of a pair of adjustable cross-beams mounted therebetween; two pairs of co-operating links, one link of each pair being pivotally secured to said cross-beams and the other link of each pair being secured to a presser block; said presser-block; a shaft rotatably mounted in hangers; said hangers adjustably mounted in said supporting members; and means operatively connecting said links with said shaft, whereby the rotation of said shaft causes said presser-block to be raised and lowered.

The Oregon Portland Cement Co., of Portland, Oregon has been organized, capital \$400,000. The company own a tract of land, near Portland, upon which the Company's plant is to be built.

M. H. Clark of Minneapolis, Minn., and W. R. McGarry and others are interested in the project.

The Iroquois Portland Cement Co., at Calidonia shut down, and is now in the hands of a receiver. 150 men were employed. The local press states that a difference between the stockholders in regard to the management of the plant was the cause of the Company's suspension. There is some talk of a settlement which will enable the plant to resume in February, 1908.

The Lehigh Cement region is feeling the effect of scarcity of ready money, several plants have shut down. The Edison Cement Co., posted notices on Nov. 20 that the works would shut down except the grinding and shipping department. Several plants are getting rid of the foreign employees, retaining their American workmen. Some 285 Italian and Hungarian workmen have left for Europe.

The 4th Annual Convention of the National Association of Cement Users, will be held at Buffalo, N. Y. January 20 to 25, 1908.

Application for space must be made to Dai H. Lewis, 760 Main St., Buffalo, N. Y., who will furnish detailed information, relating to the Convention.

Allis-Chalmers Company has engaged for its office in St. Louis, Mo. a new suite of offices located at 1302-1304 Third National Bank Building, where the Company's District Manager, Mr. F. L. Bunton, and the salesmen of his staff, will be prepared to receive visitors after January 1st, 1908.

An instrument for indicating frost 12 hours in advance has been placed upon the market by The Tonindustrie Zeitung of Berlin, Germany.

Wm. Ham Hall, C. E. of San Francisco, Cal., made a systematic investigation of the injury wrought by the earthquake to the buildings at San Francisco and surrounding territory, all of which has been embodied in a detailed report. Mr. Hall's entire time being spent on the ground for many months. This report is now in book form and on sale by the author.

Mr. Hall is now making a detailed investigation of the rebuilding of San Francisco. The following data relating to reinforced concrete construction from the pen of Mr. Hall appeared in the California Architect and Engineer:

There are now under way or completed in San Francisco, seventy-six concrete buildings as follows: 4 one story buildings, 11 two stories, 21 three stories, 8 four stories, 7 five stories, 9 six stories, 8 seven stories, 1 nine story and 1 ten story. The value of these seventy-six buildings is \$6,178,000. This is a notable showing since reinforced concrete construction was not permitted before the earthquake.

The Fellner & Ziegler Machine Works of Frankfort, Germany, furnished 1 Rotary Kiln for a cement plant in Siberia, and two Rotary Kilns for a plant at Buenos Ayres, Argentine Republic.

Vienna, Austria, has a population of 1,988,687, living in 38,763 buildings containing 444,997 apartments.

The Golden State Portland Cement Co., of Tehochapi, Kern Co., Cal., has been organized with a capital stock of \$2,000,000. A cement plant is to be built near Tehochapi. Geo. W. Parsons of Los Angeles, Cal., is treasurer of the company.

The Golden State Pot Cement Co. of Tehochapi, Kern Co., Cal., is

to erect a large cement plant at the above named place. Capital \$2,000,000. Geo. W. Parsons of Los Angeles, is treasurer of the company.

Three hundred and fifteen million lead pencils are made in the U. S. each year, requiring 7,300,000 cubic feet of wood, the greatest portion being cedar, which is becoming scarce and for which no equally good substitute has been found.

A new composition for molds and ornamental cast figures is prepared as follows:

50 parts sand, 100 parts powdered clay, 20 parts magnesium chloride and 20 parts carbonate magnesium, all to be thoroughly mixed dry, add sufficient water, to make a stiff mortar, add 5 parts borax, which retards the setting so the mixture can be more conveniently handled.

The Iola Portland Cement Company which has a capital of \$4,500,000, and incorporated under the laws of West Virginia has been granted a charter to operate in Kansas for which a fee of \$2,337.56 was paid.

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1 per cent
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Low in moisture.**

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The Cement and Concrete industry has developed so rapidly that qualified experts are rare. Reinforced concrete is being used more and more in building and construction work. Experienced and practical concrete engineers are everywhere in demand. This new field in the building industry has opened unlimited opportunities to the young man in the architect's or contractor's office. The progressive architect, contractor and builder is taking advantage of every opportunity to learn more about reinforced concrete, the uses to which it may be put and the results that may be expected from it.

THE CYCLOPEDIA OF Architecture, Carpentry and Building

is an absolutely new work and its chapters on Reinforced Concrete are absolutely up-to-date and contain some of the most authoritative and latest information on this vital subject that has yet been printed.

This is an unusual opportunity for increasing your knowledge of your own trade or business—even aside from the acquiring of special knowledge about cement and concrete work. A glance at the brief table of contents below will convince you that it is laden with money earning, money saving, money producing, practical plans and ideas.

TEN VOLUMES page size 7 x 10 inches, bound in half red morocco, over 4,000 pages, 3,000 illustrations, full page plates, plans, sections, etc. DeLuxe books in every particular.

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BRIEF TABLE OF CONTENTS.

Reinforced Concrete, Cement, Testing, Mixing, Frost Effects, Finishing, Construction Forms, Elasticity, Resistance, Retaining Walls, etc., Structural Steel Buildings, Practical Problems in Construction, Estimating, Superintendence, Contracts, and Specifications. The Law of Building Contracts, Materials, Masonry, Foundations, Carpentry, Stair Building, Framing, Steel Square, Plastering, Hardware, Painting and Glazing, Heating, Furnace, Steam, Hot Water, Plumbing, Ventilation, Electric Wiring, Bells, Lights, Burglar Alarms, Elevators, Architectural Drawing, Mechanical Drawing, Freehand Drawing, Perspective Drawing, Shades and Shadows, Architectural Lettering, Rendering in Pen and Ink, and Wash, Water Coloring for Draftsmen, The Greek and Roman Orders of Architecture, Roofing, Tinsmithing, Sheet Metal Cornices, Test Questions.

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Cem. & Eng
News, 11-07

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Are the principal factors to be considered in the location of a Portland Cement industry. These conditions exist at a number of points on the lines of the Santa Fe, which company is pleased to co-operate with those seeking locations, or desirous of investigating conditions in its tributary territory. Correspondence from interested manufacturers is invited.

WESLEY MERRITT

INDUSTRIAL COMMISSIONER

1122 RAILWAY EXCHANGE

CHICAGO

The Weber Steel Concrete Company of Memphis, Tenn., has been incorporated, capital \$250,000. The officers of the company are as follows:

Gardner P. Nash, of the Weber company, president; R. T. Fant, president of the Security Bank and Trust company, of Memphis, vice-president; B. E. Jarratt, former principal of the high school at Fort Smith, Ark., secretary and treasurer; L. W. Campbell, secretary and treasurer of the Shelby County Dairymen's Association; T. Floyd Turley, Memphis attorney; Richard E. Steen, president of the company at Chicago, and several others will probably be added in a short time as directors.

The company will operate under the Weber Steel Concrete Chimney Co., patents, which include various kinds of reinforced concrete building constructions.

Come to the Chicago Cement Products Exhibition Dec. 17 to 21st, where up-to-date Cement Machinery and Products will be displayed.

During the first eight months of the present year, 723,300 alien steerage passengers landed in New York.

Railway Construction crews are being laid off earlier in the season than usual, this reduced the demand for cement. About 6,500 men were laid off on four Railway lines alone, during the last two weeks in October.

Enter your Cement Machinery and Products at the great Chicago Cement Show, Dec. 17 to 21st, do so at once.

Technical men in all lines. Wanted Superintendents, Engineers, Draftsmen, positions waiting in all sections of the country. Write today. HAPGOODS, 305 Broadway, N. Y., or 1010 Hartford Bldg., Chicago.

WANTED—A position as chief chemist by a young man with good technical education and three years' experience in the manufacture of Portland cement, from limestone & clay, dry process. Best references. Address R. E. R., care Cement & Engineering News.

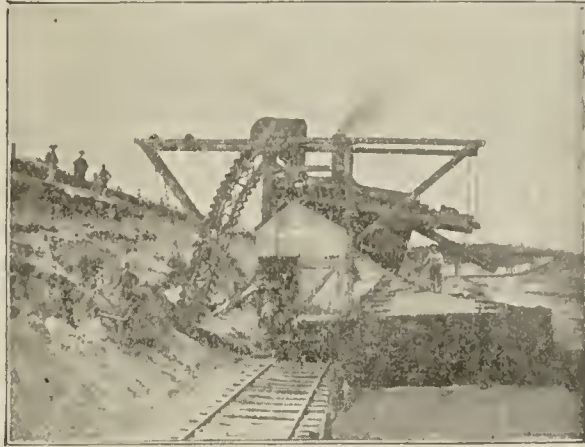
C. A. P. TURNER, M. Am. Soc. C. E.

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Assistant Engineer, Eng. Dept. U. S. Army, Member American Society Civil Engineers

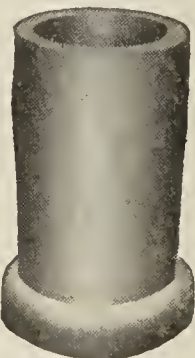
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CLARINDA TILE & BRICK FACTORY

PAUL O. COOK, Proprietor

Clarinda, Iowa, Dec. 17, 1906.

Miracle Pressed Stone Co., Minneapolis.

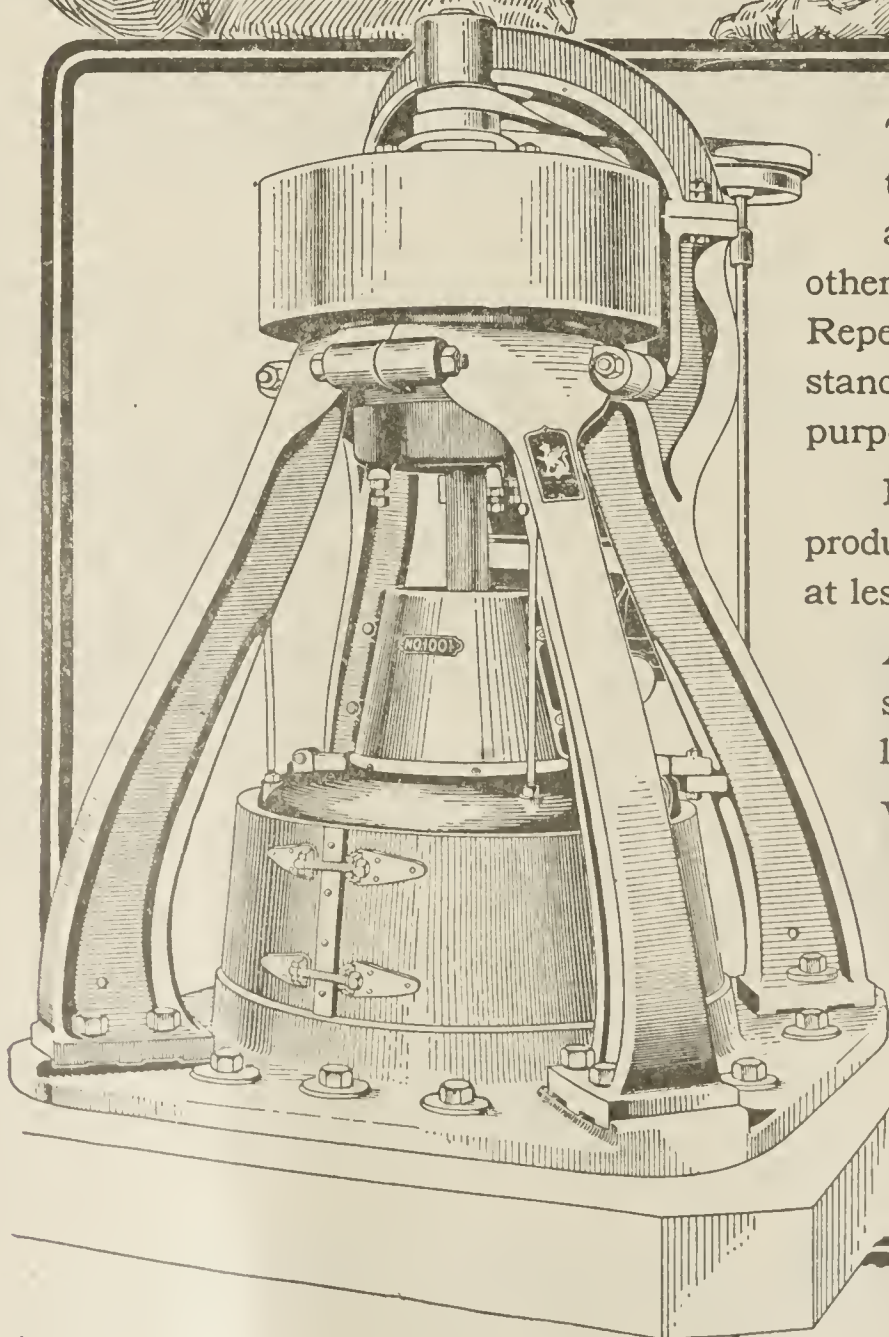
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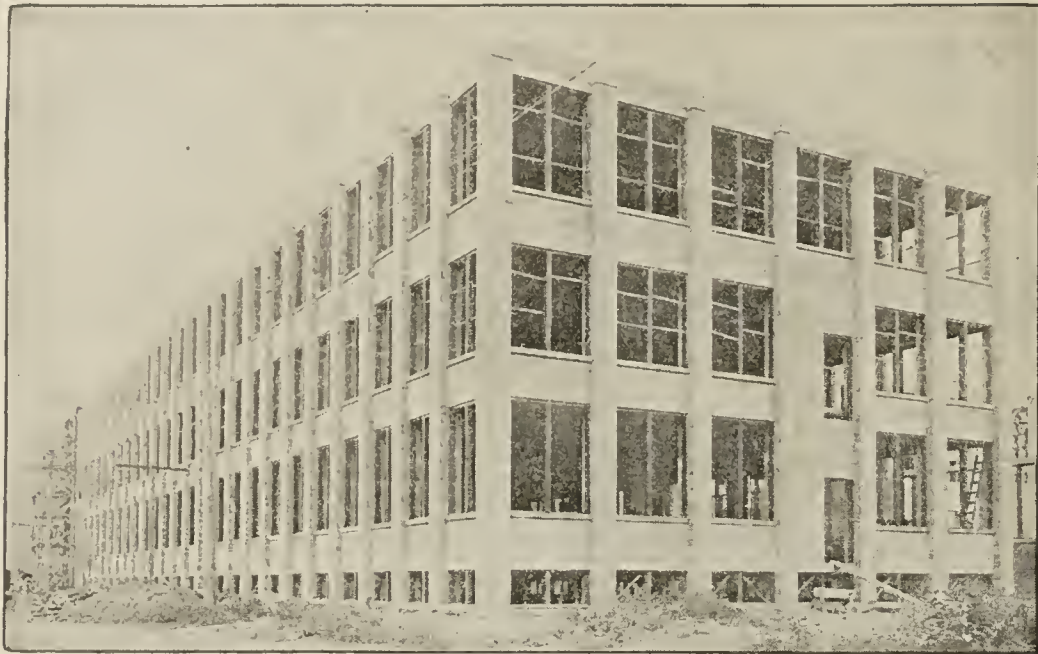
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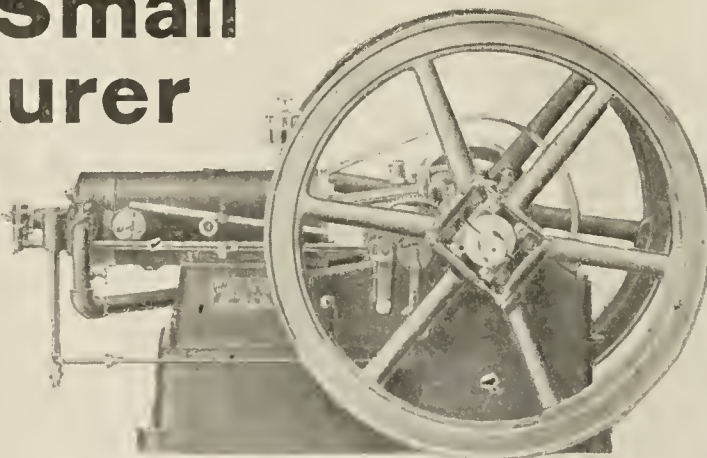
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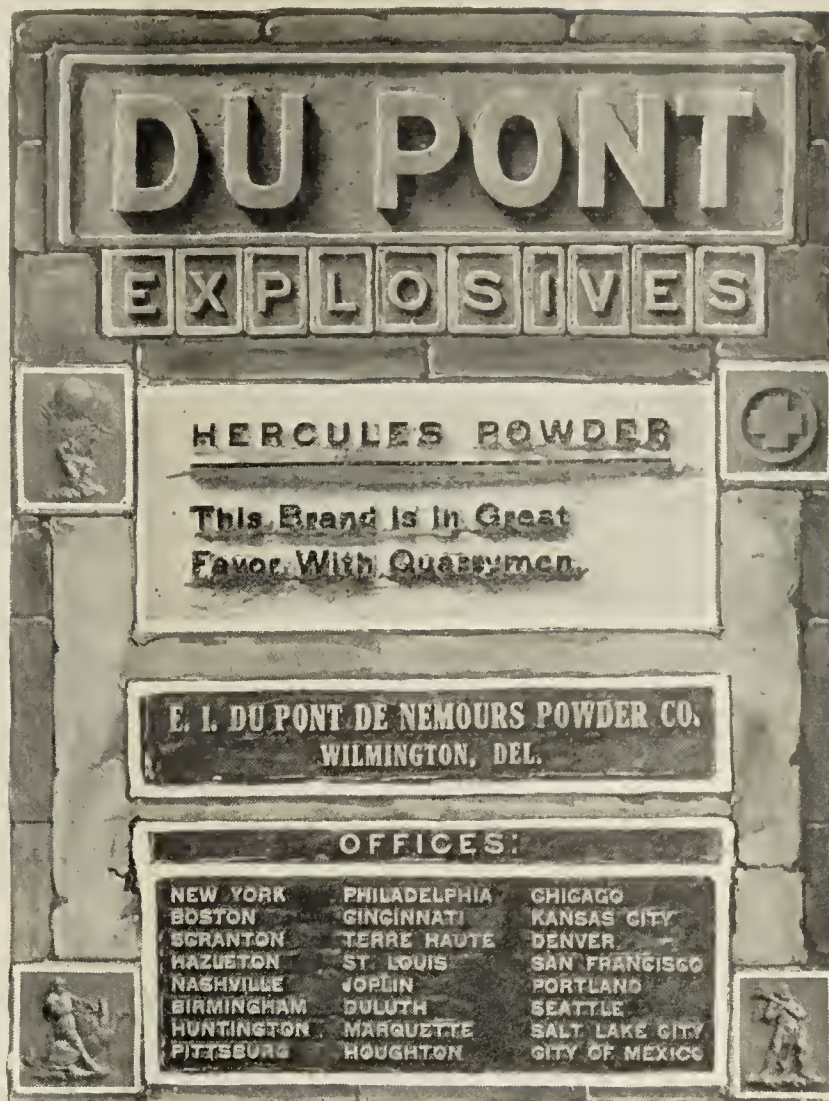
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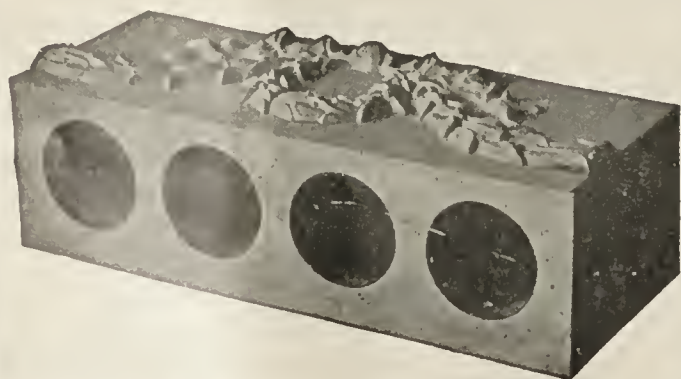
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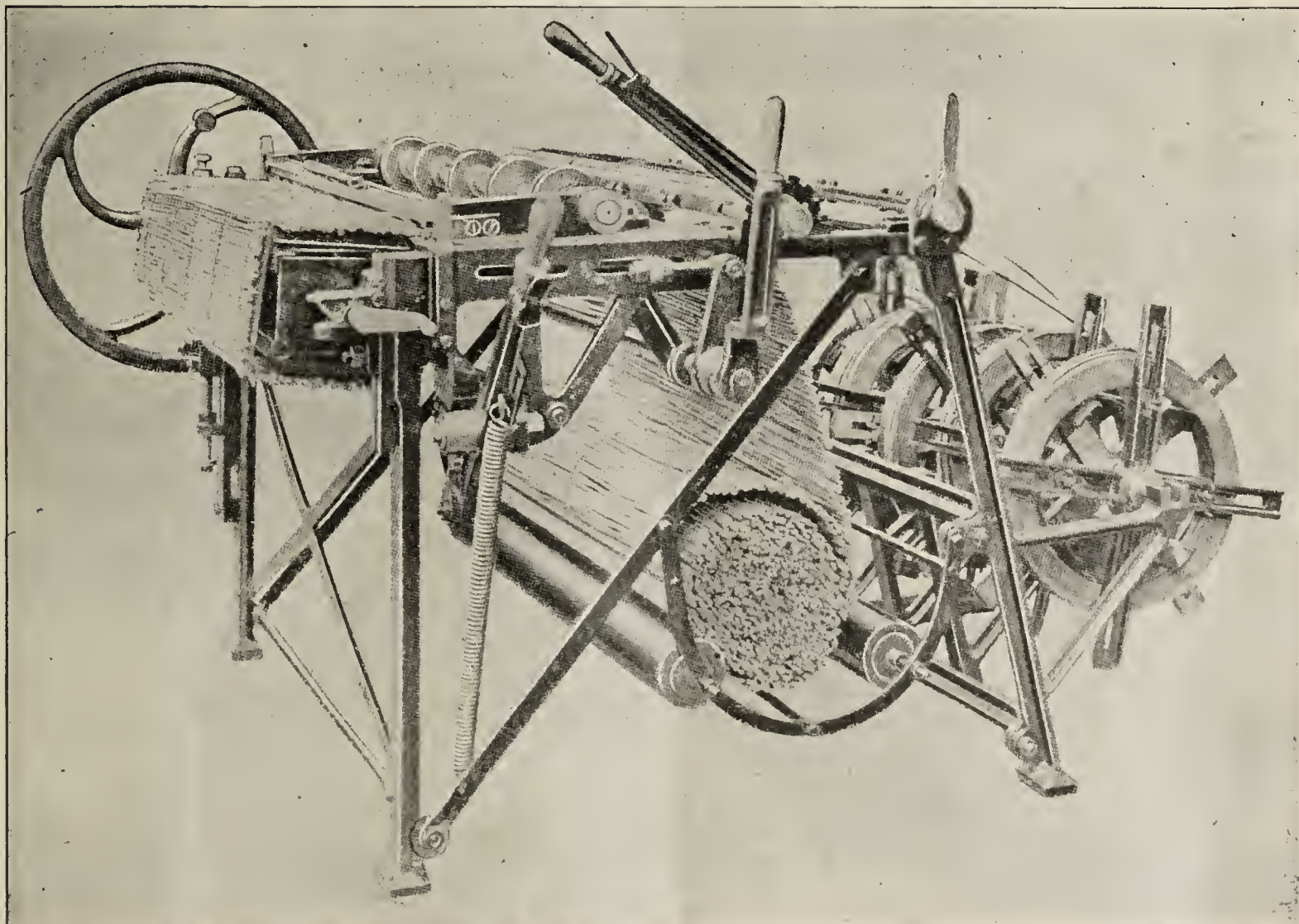
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CEMENT

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ENGINEERING NEWS



Machine for Manufacturing Hollow Reed Covered Tile, Used in Reinforced Concrete Construction Work by the G. A. Ways Company, Vienna, Austria, and Several Subordinate Construction Companies. See Page 280 for Description.

CEMENT AND ENGINEERING NEWS

(PUBLISHED MONTHLY)

WILLIAM SEAFERT, Editor and Publisher

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CHICAGO, DECEMBER, 1907.

CORRESPONDENCE.

We solicit correspondence on all matters of general interest to the cement trade in all its branches. Engineering notes, public improvements, and facts and opinions drawn from practical experiments will be welcome.

THE CHICAGO CEMENT PRODUCTS EXHIBITION.

The Chicago Cement show was an unqualified success, far exceeding the most sanguine expectations of the promoters. It fully represented Chicago push and energy, and considering the fact that only six weeks were given to the carrying out of the enterprise from the day it was conceived and organized to the day of the opening, entitles its projectors to great credit for this swift execution. The exhibition was conducted on strict business principles throughout, and without the least friction; everyone was satisfied. Over 100,000 people were in attendance during the five days it was open. The stockholders will receive dividends instead of assessments on their shares. The exhibitors did a large volume of business on the floor and expect to close many more orders in the future as a result of their individual displays. Every department of the Cement industry was well represented. The Atlas Cement Co., booth made a creditable display of raw and finished cement materials, statuary and reliefs. The entire rear partition was covered with photographic views of its 22,000 bbl., Northampton mill, the largest in the United States. George W. De Smet who represents the Vulcanite Portland Cement Co., and the Ornamental Tile Co. was the center of interest. The Ornamental tile and Colored Portland Cement

was a center of continuous interest. Samples of various colored Portland Cement were displayed. The Garden City Sand Co. exhibited the Stevens Cast Stone products. The Toch Waterproofing Compounds, and its own compound Portland cement plaster. The Ideal Concrete Machinery Co., was also a center of interest. Numerous shingle Companies made creditable displays. The Marquette Cement Co.'s exhibit attracted great attention; an illuminated cement house in their booth was always full of visitors. The Booth of the Chicago Portland Cement Co., was the meeting place of numerous friends and customers and was most attractive.

The Lehigh Portland Cement Co.'s booth was another place of meeting for friends and customers alike.

The display of the Miracle Pressed Stone Co., of Minneapolis was the largest at the show in the way of machinery and devices used in concrete construction, concrete molds and specialties such as ornamental tombstone forms, etc. The Sandusky Portland Cement Co., displayed samples of white cement in addition to their regular line of straight Portland cement; showing the Medusa waterproofing and samples of white Portland cement ware from their new white Portland cement plant at York, Pa. These exhibitions will be held annually in Chicago hereafter.

THE SHIP WORM.

The Teredo or ship worm belongs to the Mollusk family of which over 20 varieties are found in different parts of the ocean. It bores into submerged wood such as the bottom of ships and piles. It is microscopic in size it enters the wood where it grows sometimes to over 4 feet long, feeding on the wood fiber. The Teredo is armed with two or more cutting shells at the mouth which is likewise lined with a shell or stone like coating. These shells are worked by powerful muscles which terminate in the gills. The Teredo is so numerous in certain waters in warm climates that wooden structures are soon weakened and destroyed. For this reason cement structures such as for piling docks are coming into favor. The Teredo family and its ravages are fully described in the report of the United States Fish Commission for 1871-2 page 383.

CONVENTION OF NATIONAL ASSOCIATION OF CEMENT USERS.

The National Association of Cement Users will hold its 4th annual convention at Buffalo, N. Y., January 20 to 25, 1908. The meetings will be held in the Concert Hall in the Tech. Theatre Building on Main St. The Exhibition of Machinery will be displayed in the 65th Regiment Armory, which is one of the largest halls in the country. The floor space being greater than either the Tattersall or Coliseum. The available space is being picked up very rapidly by the numerous exhibitors from all parts of the country who will show the latest appliances and devices employed in the use of cement. All railway associations have granted reduced rates under the usual limitations and restrictions. The rate being one and one-third fare, for the round trip, on the certificate plan. Each purchaser of a ticket must obtain a certificate from the ticket agent at stations designated. A regular certificate and not a receipt must be taken to secure the reduced rate. The rules governing the sale of the reduced rate tickets are as follows:

1. Tickets at full fare for the going journey may be secured within three days (exclusive of Sunday) prior to and during the first three days of the meeting. Tickets cannot be obtained earlier than January 16 or later than January 22. A certificate must be obtained at the time of the purchase of the going ticket. A receipt for the fare paid is not a certificate.

2. The ticket and certificate must be purchased at the railroad station at least thirty minutes before the departure of the train.

3. Certificates are not kept at all stations. Inquiry should be made of the station agent at the starting point as to the nearest point at which certificates can be obtained, should it be impossible to secure certificates at the starting point. A local ticket should be purchased to the nearest station at which a certificate and through ticket can be obtained.

4. The certificate must be presented to the Secretary of the National Association of Cement Users immediately upon arrival at the Convention.

5. A special agent of the railroad associations will be in attendance at the Convention to validate certificates for January 21 to 25 inclusive. A fee of twenty-five cents will be collected for each certificate validated. Certificates will not be validated prior to the special agent's

arrival or after the special agent has left. No refund of fare will be made on account of failure to have certificate validated.

6. The reduction of fare for the return journey is not guaranteed, but is contingent on an attendance of not less than 100 persons holding certificates obtained from ticket agents at starting points, showing payment of full first-class fare of not less than 75 cents on the going journey.

7. Should the necessary minimum be in attendance, each certificate properly validated will entitle the holder to a continuous passage ticket, up to January 29, to original starting point by the same route over which the going journey was made, at one-third the limited fare.

These instructions should be carefully followed. The receipt for 1907 or 1908 dues must be shown at the time of the countersigning of the certificates as evidence of the right of the holder to the privileges extended by the railroads.

Hotel Accommodations.

The headquarters of the Convention will be in the Iroquois Hotel. The following rates have been obtained from the leading hotels in Buffalo, and the Association has been guaranteed that there will be no increase in rates during the Convention.

All per diem rates quoted are on European plan only.

Iroquois Hotel: Rooms without bath, one person \$2.00; two persons \$3.00; with bath, one person, \$3.00 to \$3.50; two persons \$5.00 to \$6.00.

Lafayette Hotel: Rooms without bath, one person \$1.50 up; two persons, \$3.00; with bath, one person, \$2.50 up; two persons, \$4.00 up.

The Genesee Hotel: Rooms without bath, one person, \$1.00 to \$2.50; two persons \$2.00 to \$4.00; with bath, one person \$2.00 to \$3.00; two persons \$3.00 to \$5.00.

Niagara Hotel: Rooms without bath, one person \$1.00 to \$1.50; with bath, one person, \$3.50 to \$4.00.

Lennox Hotel: Rooms without bath, one person \$1.50; two persons, \$2.00 to \$4.00; with bath, one person, \$2.50; two persons, \$3.50 and up.

Over ninety exhibits have been entered comprising the leading representatives of the cement industry in the country.

TENTATIVE PROGRAM.

Monday, Jan. 20, 1908.

1. Formal opening of the Exhibition in the old Sixty-fifth Regiment Armory at 12 o'clock noon.

Tuesday Morning, Jan. 21.

2. Formal opening Convention, Concert Hall, 10 a. m.

3. Address of Welcome by Mayor James N. Adams, Buffalo, N. Y.

4. Response by the President, Richard L. Humphrey, Consulting Engineer, Philadelphia, Pa.

5. Business Session.

6. Cement Sidewalks, C. W. Boynton, Chicago, Ill.

7. Report Committee on Streets, Sidewalks and Floors, George L. Stanley, Chairman, Ashtabula, Ohio.

Tuesday Evening, Jan. 21, 8 o'clock.

8. President's Address, Richard L. Humphrey, Consulting Engineer, Philadelphia, Pa.

9. Elementary Mechanics of Reinforced Concrete, Prof. W. H. Hatt, Professor of Civil Engineering, Purdue University, Lafayette, Ind.

10. Factory-built Concrete, W. H. Mason, Superintendent, Edison Portland Cement Company, Stewartsville, N. J.

11. The Necessity for Continuity in the Steel Reinforcement of Concrete Structures.

Wednesday Morning Jan. 22, 9-10 o'clock.

12. Meeting Section on Concrete Blocks and Cement Products.

10 o'clock.

13. Report Committee on Testing Cement and Cement Products, E. S. Larned, Chairman, Boston, Mass.

14. Report Committee on Concrete Blocks and Cement Products, S. B. Newberry, Chairman, Sandusky, Ohio.

15. Report Committee on Machinery for Cement Users, M. Wetzstein, Chairman, South Bend, Ind.

15a. Co-operation: What it is and What it can Accomplish, Robert W. Lesley, President of American Cement Company, Philadelphia, Pa.

15b. Business Session.

(a) Report of Executive Committee.

(b) Place of next Convention.

(c) Election of officers.

Wednesday Evening, Jan. 22, 8 o'clock.

16. Concrete as a Plastic Material for the Expression of Architectural Ideals, Irving K. Pond, Architect, Chicago, Ill.

17. Treatment of Concrete Surfaces.

18. Artistic Effects in Reinforced Concrete, Ross F. Tucker, President Concrete Association of America, New York, N. Y.

19. Exposed Selected Aggregates in Monolithic Concrete Construction, Albert Moyer, New York, N. Y.

20. Report Committee on Art and Architecture, Charles D. Watson, Chairman, Pittsburg, Pa.

Thursday Morning, Jan. 23, 9-10 o'clock.

21. Meeting Sections on Reinforced Concrete; Streets, Sidewalks and Floors.

10 o'clock.

22. Progress in Manufacture and Use of Cement Building Blocks, A. N. Pierson, East Orange, N. J.

23. Proportioning and Mixing Cement Mortars and Concretes.

24. Architectural Concrete in Landscape Work.

25. Waterproofing Cement Structures.

Thursday Evening, Jan. 23.

Reserved for Social Entertainment.

Friday Morning, Jan. 24, 9-10 o'clock.

26. Meeting Sections on Laws and Ordinances; Fireproofing and Insurance.

10 o'clock.

27. Practical Methods Involved in the Erection of a Reinforced Concrete Build-

ing, H. H. Fox, Superintendent, Turner Construction Co., New York, N. Y.

28. Manipulation of Forms in Concrete Construction: (a) Wooden forms; (b) Metal forms.

29. The Unit vs. the Loose Bar System of Reinforced Concrete Construction, Emile G. Perrot, Architect, Philadelphia, Pa.

Friday Evening, Jan. 24, 8 o'clock.

30. Use of Cement in Manufacture of Drain Tiles, Roofing Tiles, Railroad Ties, Telegraph Poles, Piles and Posts.

31. Report Committee on Fireproofing and Insurance, William L. Bailey, Chairman, Boston, Mass.

32. Report Committee on Laws and Ordinances, H. C. Henley, Chairman, St. Louis, Mo.

33. Progress in the Investigation of Cement Mortars and Concretes in the Structural Materials Testing Laboratories of the United States Geological Survey, St. Louis, Mo., Richard L. Humphrey

Saturday, Jan. 25, 11 p. m.

Closing Exhibition in the old Sixty-fifth Regiment Armory.

Applications for Membership.

Applications for membership should be made on the accompanying blank, page 7, which should be forwarded to the President of the National Association of Cement Users, 1001 Harrison Building, Philadelphia, Pa.

The Railways have made a special rate of one and one third fare, plus 25 cents for round trip to the National Association of Cement Users Convention, at Buffalo, January 20th to 25th inclusive.

Enter your machinery for exhibition at the 4th annual convention of the National Association of Cement Users Convention at Buffalo, N. Y., January 20 to 25 inclusive.

AUTOMOBILE TRAFFIC. DESTRUCTIVE TO PUBLIC ROADS.

A new problem has confronted the public road makers in all countries where the automobile has come into extensive use.

The grinding effect of the rubber tire on the surface of modern pavements and how to overcome the same is troubling road engineers. Brick, macadam and even granite blocks show the wheel tracks where the automobile traffic is considerable. Asphalt pavement stands up fairly well where the surface is lubricated with oil or tar baths. This, however, is costly and can only be applied on boulevard systems under the administration of public park boards with ample funds and by continuous well directed efforts.

The one and only class of street pavements that resist the action of

the rubber automobile tire is a well made concrete surface roadway. The automobile clubs have adopted concrete pavements for their speedways on their own private grounds, on these ways the highest speed is made, with little or no wear and tear, simply because concrete surfaces are not effected by the abrasive action of the rubber tire. Even when such a tire is armored or shod on its periphery the granite block shows little or no wear from the effect of the simple grinding of the tire upon its exposed surface, the block simply becomes loosened and sinks forming a cut or continuous wheel track, while the concrete paved way preserves its form intact. Where the concrete has been properly laid with good materials no trouble has been experienced. The city of Chicago is now preparing an ordinance to tax automobiles \$30 per year. The money so collected from all wheel vehicles estimated at \$750,000 per annum, is to be applied to the building and repairing of the city streets. This work has heretofore been paid for by special assessment levied on the property fronting on the streets where paving has been done.

The National Association of Cement Users Exposition at Buffalo, N. Y., January 20 to 25. Don't miss it.

INCREASED COST OF LIVING IN EUROPE.

The latest European reports indicate that food and clothing prices have advanced from 15 to 60 per cent and over, while wages of the working classes have likewise increased from 25 to 66 per cent; this is especially true of Germany and France, the one notable exception being that of salaried men, whose compensation has increased to correspond with the increased cost of the necessities of life. The following is the average increase in price of the commodities in Germany: Cereals, 25 per cent; meat, 27 per cent; imported agricultural products, 20 per cent; cloth and other woven fabrics, 55 per cent; mineral products, 60 per cent; coal, 15 to 22 per cent. The wages of English laborers has increased. Coal has gone up \$1.00 per ton. Flour per sack 280 lbs. has risen \$1.95 per sack in six months. Higher wages and the increased cost of fuel in Europe means increased cost of production, and therefore the competition in the markets of the world with the United States

must be done on a narrower margin, especially with the cement industry, where the fuel item is a great factor in cement production.

Write to Dai. H. Lewis, manager of the National Association of Cement Users Exposition, 760 Main St., Buffalo, N. Y., for space for your exhibit.

REINFORCED CONCRETE WINE TANKS.

United States Consul Johnston states that reinforced concrete tanks are extensively used in Algiers, for storing wine or oil. The tanks have a capacity of from 260 to 2500 casts of 52 gallons each. The concrete is faced with glass tiling 5 1-2 by 10 1-2 inches on the inside. Wine is stored, mixed and blended in these tanks. They are also used on a much larger scale in France. In California concrete tanks for wine storage are built on a large scale, one tank having a capacity of over 30,000 bbls.

OWNERS LIABILITY FOR ACCIDENT DURING BUILDING CONSTRUCTION.

The failure of certain structural members in the reinforced concrete Bixby Hotel building at Long Beach, Calif., resulted in personal injuries to a number of the contractors and employees who sought to hold the Long Beach Hotel Company liable as owners of the Bixby hotel for negligence. A number of law suits were brought by these workmen in the California courts. The Plaintiffs in this petition set out that the Architect's plans for this hotel were defective, and that the Defendants as owners, received and passed these defective plans. The evidence at the trial showed that the plans were not defective, and even if they were the owner is not liable if the owner had exercised reasonable care in the selection of an Architect; that the accident was due to faulty construction, and that the workmen had sufficient time to escape after the first warnings of the crash which was followed by a pause sufficient to permit some of the men to escape before the upper floor gave away carrying down one section of floor after the other. Judge Curtis D. Wilbur before whom the case was tried found for the defendant on the ground that the evidence did not show any defects in the architects' plans sufficient to cause the collapse.

CAST CONCRETE HOUSES.

H. J. Lecomte, a Mexican inventor claims priority over Thomas A. Edison in the matter of casting concrete buildings in one piece, a patent granted to him under date of Dec. 14, 1901, by the Mexican government, and another being an improvement on the original patent under date of March 23, 1903. The Edison patents, however, cover many details in which are not embraced in the Lecomte patents.

Enter your machinery for exhibition at the 4th annual convention of the National Association of Cement Users Convention at Buffalo, N. Y., January 20 to 25 inclusive.

DECLINE IN OUR HARDWOOD TIMBER RESOURCES.

While the demand for hardwood has greatly increased, the cut is now a billion feet less than it was seven years ago. Hardwood lumber is now from 25 to 65 per cent higher.

In 1899 the oak cut represented more than one-half of the entire hardwood output. The oak cut has fallen off 36 per cent, Yellow poplar, formerly second in point of output has fallen off 38 per cent, white elm cut has declined 50 per cent.

The output of soft woods is over four times that of the hardwoods. A shortage of the former would not be so disastrous to so many industries depending upon hardwoods as raw material stock which is used in cooperage, furniture, vehicles, agricultural implements, poles for telegraph and telephone lines. Timber for bridges and buildings are extensively used.

Where is the future hardwood supply to be obtained? In Ohio and Indiana, which seven years ago lead all other States, the output has declined over 50 per cent, the same is true of other states except Arkansas, Louisiana and Mississippi where the hardwood output is at its extreme height. The Appalachian Mountains now have the largest body of hardwood timber in the country. On these mountains grow the largest variety of tree species anywhere to be found. 75 million acres of forest land in the Appalachian range if rightly managed should yield (20,000,000,000) twenty billion feet of hardwood annually.

Come to the 4th annual convention of the National Association of Cement Users Convention at Buffalo, N. Y., January 20th to January 25th, 1908.

BARTON'S SYSTEM OF REINFORCED CONCRETE CONSTRUCTION.

Frances M. Barton, Architect.

Royal Insurance Bldg., Chicago, is introducing a system of Reinforced concrete construction without beams or girders, the columns and walls convey continuous reinforced floor slabs.

The columns formed of four angle irons which are spaced, bolted and hooped together. The columns are three stories high set into bases which are lined up 16 feet from centers, at the height of each floor carrying rods radiate from each column and extend to the full width of the span to the next set of columns and properly anchored distributing rods are then placed over the tension or conveying rods. The columns are either wire bound or hooped. The false work consists of forms for the columns, which are enlarged in the form of an inverted bell just below the false work upon which the floor slabs are formed. Where the outside walls are in place two stories high the concreting can be done on both stories at the same time.

The Foot Brother's Gear & Machine Co's. factory building, Carpenter and Fulton St., Chicago, will be constructed on the Barton system. A small model 1-12 size in this system has been tested and carried a load of 170 pounds per square foot, the floor slabs being only 13-16 of an inch thick, which in a full size structure would represent a conveying capacity of 2040 pounds per square foot. There was no deflection in the model under the load of 170 pounds per square foot.

The principle point of utility in the Barton system is the fact that more than one floor can be placed under construction at the same time.

The Railways have made a special rate of one and one third fare, plus 25 cents for round trip to the National Association of Cement Users Convention, at Buffalo, January 20th to 25th inclusive.

THE USE OF CONCRETE IN FREEZING WEATHER.

By E. P. Goodrich.

Consulting Engineer, 1170 Broadway, New York.

Concrete may be mixed and placed during freezing weather with perfect safety provided certain conditions obtain or certain precautions are taken.

In mass work, where only relatively light loads will come upon

the concrete until such time as it has had an opportunity to thaw out and reharder, and where the superficial appearance is of no importance, no precautions need be taken to prevent freezing.

In cases where freezing must be prevented until at least the initial set has taken place, three different methods may be used separately or in combination, viz.:

(a) The concrete aggregate may be heated, or hot water or steam may be used in the mixing. This hastens the set.

(b) Sodium chloride, calcium chloride or other chemicals may be added, so as to lower the freezing point of the water.

(c) The work may be enclosed and the interior of the enclosure maintained above a freezing temperature until the concrete set naturally.

The heating of the aggregate is always advisable so as to preclude the possibility of frozen lumps of sand or larger aggregate getting into the completed work. In one case the writer removed from a reinforced concrete column during the depositing of the concrete, a lump of frozen sand which would have occupied fully fifteen per cent. of the effective column area. Even when boiling hot water is employed, the mixing process does not usually occupy enough time to thaw out frozen lumps, even of small size. The sand and other aggregate should always be heated.

The writer always advocates heating the water also. A small expenditure will cover the cost of the apparatus necessary for this purpose, and the fuel bill is relatively small. If steam is employed for this purpose, it will be found exceedingly valuable to lead a pipe or hose to the point of deposit and heat and clean the forms, and the reinforce-

ment, if used. The writer has often taken the temperature of the concrete at the moment of depositing, and periodically for hours afterwards, and has observed temperatures of 70 to 80 degrees F. in the concrete being deposited and temperatures of over 40 degrees F. six hours afterward, when the workmen commenced to travel over the fresh concrete, simply laying planks for runways.

It is usually impracticable to place concrete at temperatures below 20 degrees F. because of the effect of the cold upon the workmen. The writer has, however, successfully placed many yards at temperatures down even to zero, where the men were protected and where the mixing and placing operations were so arranged as to be of exceedingly short duration for each batch.

The erection of a canvas or other more substantial enclosure completely around the work involved, is always effective but somewhat costly. Heat may be obtained from salamanders, temporary steam coils, etc., and the writer has thus often succeeded in thawing out frozen floor slabs covered on top only with hay and canvas. Canvas alone in such locations is not sufficient protection the dead air imprisoned in hay or shavings being necessary as an insulator.

For mass concrete work, the use of chemicals added to the water may be advisable where the temperatures do not fall much below the freezing point. The writer has used no chemical except common salt, which has shown good results in several experiments, and no detrimental results in actual work.

The safest and most economical method of handling the concrete for each separate operation must be determined for itself. In freezing weather it may be advisable to man-

IMPORTS OF CEMENT INTO THE UNITED STATES.

WHERE FROM	OCTOBER				TEN MONTHS ENDING OCTOBER			
	1906		1907		1906		1907	
	Quantity in lbs.	Value in Dollars.	Quantity in lbs.	Value in Dollars.	Quantity in lbs.	Value in Dollars.	Quantity in lbs.	Value in Dollars.
United Kingdom	29,104,710	\$82,984	52,937,005	\$198,954	154,378,456	\$450,695	198,279,021	\$ 700,226
Belgium	49,197,690	141,356	9,464,744	31,954	188,070,223	624,870	201,224,729	600,110
France	453,900	1,574	444,100	1,520	8,972,482	30,624	11,030,529	41,369
Germany	60,522,176	186,613	16,390,484	59,123	245,224,821	791,766	261,020,456	838,402
All Other Europe			1,920,250	6,620	298,253	920	2,850,513	8,749
British North Am.	675,733	5,045	20,200	93	3,331,073	23,453	334,750	2,061
Other Countries	6,594,900	28,879	1,052,178	5,503	66,295,304	302,495	6,684,052	35,631
TOTAL	146,549,109	446,451	82,228,961	303,767	666,570,612	2,224,823	681,424,050	2,226,548
Domestic Exports of Cement, bbls.	31,978	54,093	108,722	162,942	480,318	768,280	785,514	1,273,019

There were 13,922,665 lbs. of imported Roman and Portland Cement, etc., in the United States bonded warehouses in Oct., 1906, valued at \$47,997, against 22,167,022 lbs. in Oct., 1907, valued at \$68,517.

For ten months ending in Oct., 1906, there were 86,010 tons of asphaltum imported in the United States, valued at \$333,766, against 107,585 tons imported in ten months ending Oct., 1907, valued at \$444,623.

ufacture the different parts of the structure in a temporary factory and afterward erect them "in the dry," as is steel. On the other hand the "wet" method may be necessary and then some scheme should be devised for handling the concrete direct from the mixer to the place of deposit without intermediate dumping. Derricks, cars, etc., will readily accomplish this.

Come to the 4th annual convention of the National Association of Cement Users Convention at Buffalo, N. Y., January 20th to January 25th, 1908.

HOLLOW REED FORMS OR TILES.

This form of hollow reed construction is intended to replace the use of the heavier terra cotta tile which does very well for ware-houses and similar heavy construction work, but for residences and lighter constructions, it becomes necessary to further reduce the weight of the floor slab and this can be accomplished by reed tiles or forms. Hollow reed covered tiles were formerly manufactured by the inventor in round forms as a filling in concrete floors, in order to make them lighter. These round forms were made by connecting a number of metal hoops 10 inches apart, with reeds which had to be fastened to the hoop at a number of places. This method required a great deal of manual labor and was also expensive. The manual labor is now dispensed with by building wooden

box forms on which the reeds are laid and tacked down with strips. This method does not require any steel or wire which makes it as light as possible, and can then be

used instead of terra cotta tile (see Fig. 2.) This construction does away with a large amount of concrete, makes the ceiling lighter and enables the plasterer to plaster right onto it.

Fig. 3. The cut shows the girder and floor slab in which the hollow reed tile is visible. In this construction the hollow reeds have been laid on the wooden forms, and reinforcing rods were placed on the wooden forms, and also reinforcing rods were placed between them, then concrete filling put in. This concrete holds the hollow tile in place, and an unnecessary amount of concrete is replaced, and the construction made much lighter. Thus every section of concrete between the hollow tiles forms a small beam with one reinforcing rod on its tension side, and after removal of the forms, plaster can be applied to the reeds and concrete, and it is easy to do this as the plaster sticks to it very easily.

Figs. 3 and 4 further show that smaller reed tiles can be used where the concrete is submitted to a higher compression, for instance over partition walls and other places.

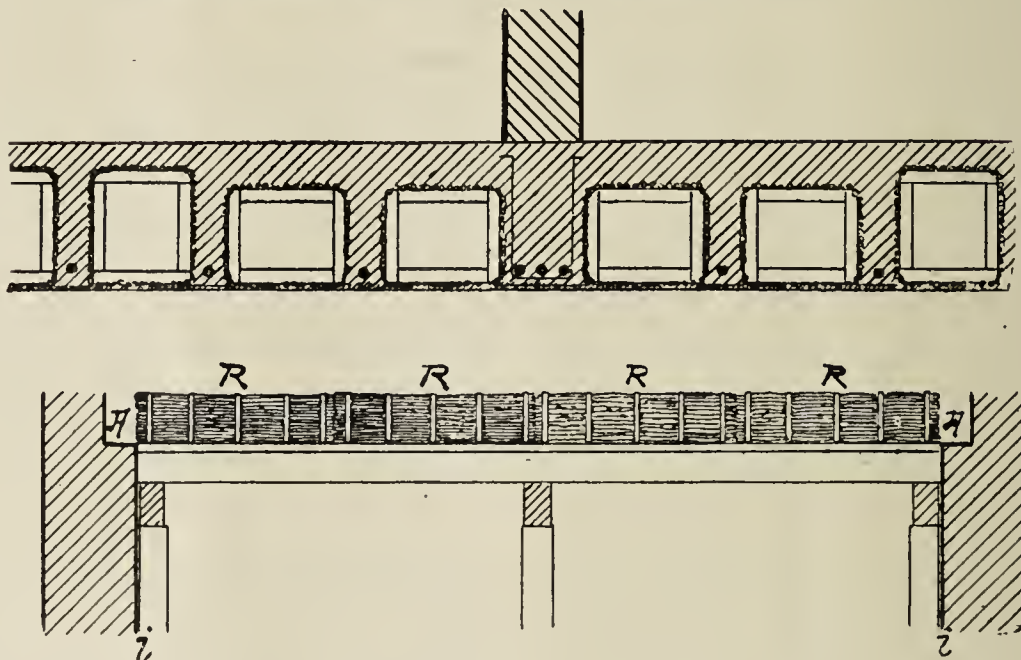
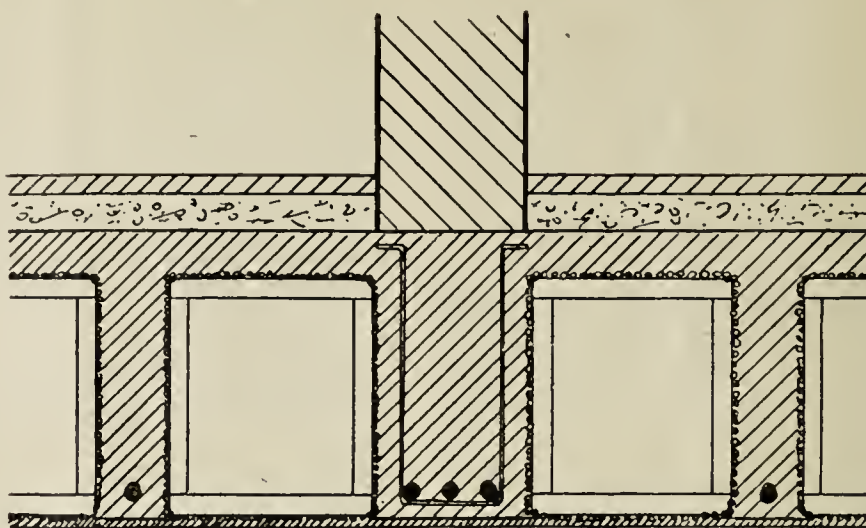


Fig. 3.

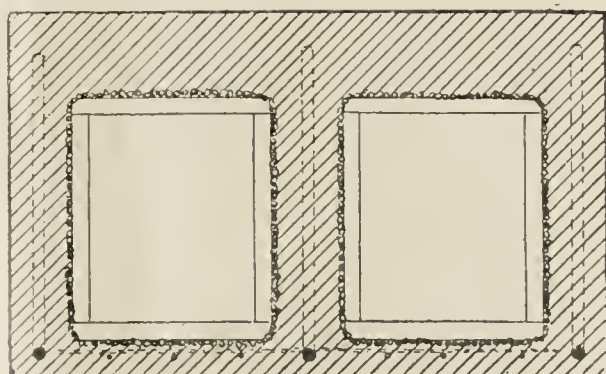
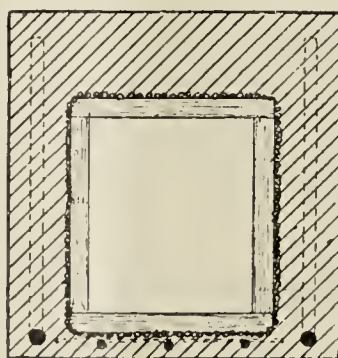
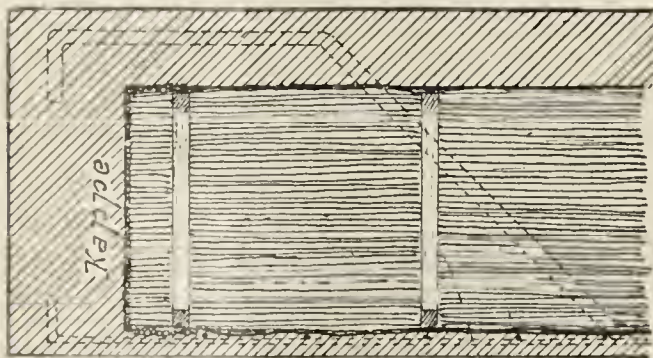


Fig. 2.

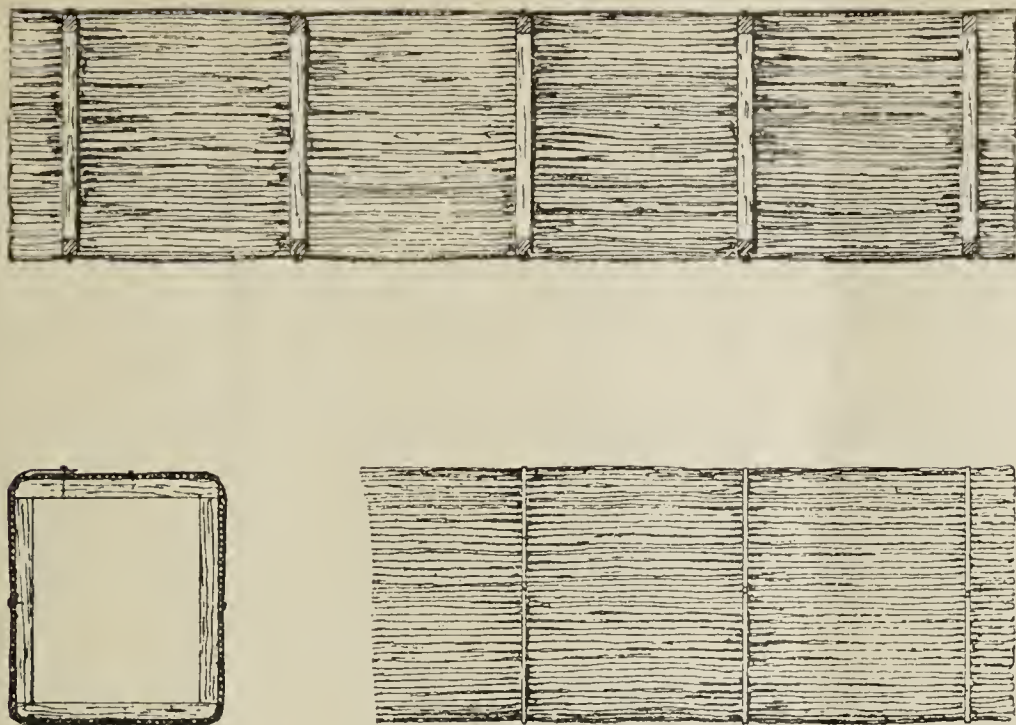


Fig. 5.

Fig. 5 shows single reed tiles or combinations of 2 or 3 tiles, which when surrounded by concrete can be used as lintels.

A machine is used for covering the wooden skeleton frame which gives form and shape to the reed covered tile. The machine consists of a frame carrying four or more grooved wheels wound with coils of wire, and grooved idlers to guide and properly space the wire, as it passes on towards the tile frame. Two idlers support a roll of reed matting one end of which is lead up to, and wound around the skeleton tile frame which is inserted onto a core, and revolved by a hand wheel as shown in Figure 1. The matting is tacked to the skeleton tile, and at the same time wound with wire which is likewise tacked onto the frame. After the tile is covered, and tacked, and wire wound, the reed matting is cut off close to the finished tile by a knife operated by a hand lever. This completed tile is then removed, and the same operation repeated again and again. The machine is adjustable for various sizes and forms as called for in different concrete floor constructions.

Come to the 4th annual convention of the National Association of Cement Users Convention at Buffalo, N. Y., January 20th to January 25th, 1908.

EMBEDDING WIRE IN CONCRETE TUBE.

The following is the invention of the Scandinavian Cement Mfr's. Company of Stockholm, describing the method by which a spiral wire is

embedded in a concrete tube for the purpose of reinforcing it.

The tube is made by forcing concrete through a cylindrical mold by means of a die with a spiral projection which forces the concrete against the wall of the mold and compresses it, and at the same time leaves a wire in the form of a spiral embedded in the concrete. In fig 1, the mold rests in the usual manner upon a ground plate and inside of this moves the die (d) fitted with a spiral shaped projection (e). Upon the Axis (c) of the die is a roll of wire attached (b) and from this runs the wire (a) through an opening (f) on the projection (e) and on the under side of which is also a small conducting orifice which insures the even exit of the wire. A knot is simply made in the end of the wire to fasten it into the mortar. Fig 2, shows a slightly different execution of this die by which the roll of wire is placed in the interior of the die and winds off the axis (c)

and from here the wire runs through a hole (h) in wall of the die and then through a conducting orifice (ff) of the projection (e) into the cement. Fig. 3 shows a method by which a concrete tube which has been previously made by application of slight pressure, is then put in the mold and is being compressed by forcing a conical die through the mold. In this case the roll of wire is included.

QUANTITATIVE FIELD-TEST FOR MAGNESIA IN CEMENT-ROCK AND LIMESTONE.

By Charles Catlett, Staunton, Va.

The rapid development of the Portland-cement industry implies that the country is being very carefully searched for material suitable for its manufacture. Such material can be found at a great many places; but deposits thoroughly satisfactory in chemical composition, and at the same time meeting all the other requirements connected with the economic production and profitable marketing of the product, are exceedingly few, if I may judge from the investigations which I have had to make in a number of States.

The raw mixture which by its clinkering and grinding forms Portland cement contains approximately 75 per cent. of carbonate of lime. This is found in nature as limestone or marl. The natural rock commonly carries either more than the required percentage of carbonate of lime (in which case it has to be reduced by suitable admixture of clayey ingredients) or less — in which case purer lime carbonate has to be added. The controlling ingredient, therefore, is carbonate of lime, or limestone of the right composition.

Among the most serious difficulties is that of finding limestone low enough in magnesia to meet the ex-

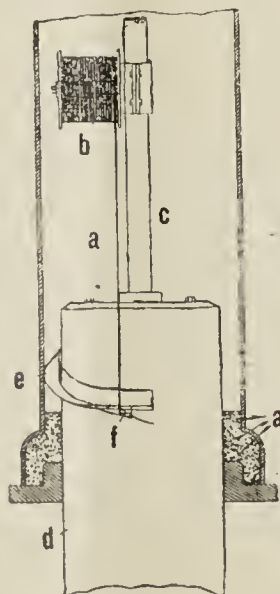


Fig. 1.

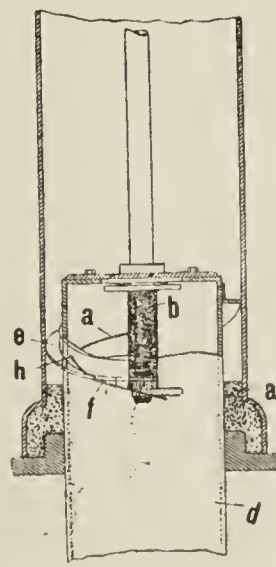


Fig. 2.

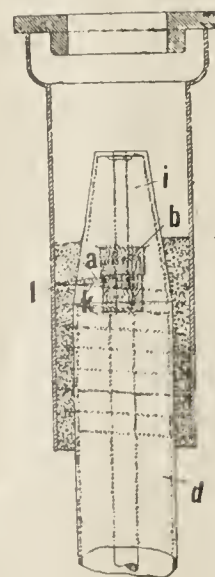


Fig. 3.

acting requirements of certain specifications. All engineers recognize that there is a limit beyond which it is not safe to let the magnesia go; but within that limit there is considerable difference of opinion. Until that difference is finally settled, no one would be willing to invest the large sum of money necessary for a Portland-cement plant, if it were not certain that the usual requirements in this particular could be satisfied.

The usual limit in well-established specifications is 5 per cent. of magnesium oxide in the finished cement, but many specifications limit the amount to 3 per cent. These figures correspond roughly to 3.2 per cent. and 1.9 per cent., respectively, of magnesium oxide in the raw mixture.

It is comparatively easy with a little practice to detect magnesia to the extent of 10 or 15 per cent. The appearance of the stone, the way it effervesces with dilute hydrochloric acid, its hardness, etc., settle this question and enable us to eliminate a great many otherwise promising deposits. It is not possible to form by superficial examination any estimate of the amount of magnesia when it is as low as 5 or 6 per cent.; yet it would be hard to overestimate the advantage of being able to determine in a few minutes, and at a point remote from a laboratory, whether a material will probably produce a cement well within the limits in this respect, and whether one is justified in securing options and taking detailed samples for further investigation. The value of such a determination would not be destroyed by the fact that it was not exact, since the purpose of a preliminary investigation would be fully met if a difference of 1 per cent. in magnesia could thus be clearly and easily detected. It would then be possible to eliminate those rocks which contained decidedly too much magnesia, and to retain, for further and more exact laboratory investigation, those which were very low in magnesia, or might possibly be low enough to meet the requirements of the case.

As the result of considerable investigation, undertaken with a knowledge of the conditions involved, my assistant, Mr. J. J. Porter (a member of the Institute, and recently elected associate professor of metallurgy at the University of Cincinnati), worked out the following method, which I have personally found valuable in this connection. The method is based on the fact that while calcium hydrate

is very soluble in a solution of cane-sugar, magnesium hydrate is only slightly so. This gives us a means of precipitating magnesia in the presence of lime.

Reagents.—1:1 hydrochloric acid: 1 volume hydrochloric acid of 1.20 specific gravity plus 1 volume of water. A 30 per cent. solution of potassium hydrate: 30 g. of potassium hydrate (pure by alcohol) to 100 cc. of water. This must be free from carbonate. Sugar-solution of granulated sugar. Calcium carbonate: C. P. precipitated. Standard limestones as needed, powdered to 40-mesh size.

Apparatus.—A small steel mortar for powdering samples; small sieve, 40-mesh size; measuring-spoon, holding between 0.4 and 0.5 g. of 40-mesh limestone powder, level full; 12 test-tubes with mark at 10 cc.; stand to hold 12 test-tubes in two rows of 6 each; a pipette, 1.75 cc., for HCl; a pipette, 1.5 cc., for sugar-solution; a pipette, 1 cc., for potassium hydrate; 6 small funnels; filter-papers to fit, uniform size; test-tube holder; alcohol-lamp; water-bottle; test-tube brush.

Method.—Crush sample, powder in mortar, and sift. Pour the powder into measuring-spoon and level off by knife-blade or card. Transfer the measured portion to test-tube.

Add from pipette 1.75 cc. of HCl, and, when effervescence has nearly ceased, boil for a moment. Then add enough pure calcium carbonate to neutralize the excess of HCl. Boil until steam issues freely from the mouth of the test-tube, in order to drive out all carbon dioxide. Add water to the 10 cc. mark, and mix thoroughly by shaking the test-tube.

In another test-tube, place, by means of the proper pipettes, 1.5 cc. of sugar-solution and 1 cc. of potassium-hydrate-solution, and dilute with water to the 10 cc. mark. Mix by shaking. Then filter the solution of the stone, allowing the filtrate to run into this alkaline sugar-solution. If magnesia is present, a precipitate of magnesium hydrate will form at the line of contact of the two solutions. After the filter has drained, these solutions should be mixed by inverting the test-tube.

The density of this precipitate is roughly indicative of the per centage of magnesia in the stone, and by comparison with standard stones run in parallel this percentage can be estimated pretty accurately, the probable error not being greater than 20 per cent. of the amount of magnesia present. As in all com-

parison methods, some practice is necessary to insure satisfactory determinations. Since the magnesium hydrate is not entirely insoluble, and some magnesia is apt to remain in the insoluble portion of the sample, the results are low. This probable error is desirable, since it is better to send samples to the laboratory for further examination than to discard something which might be satisfactory.

Notes and Precautions. — The fineness of the material affects the weight held by the measuring-spoon and also the ease of solution—hence the need of sifting.

There should be sufficient HCl to dissolve thoroughly all the carbonates of the rock; and this condition is assured if the resulting solution is yellow from ferric chloride. At the same time, it is desirable to have the smallest possible excess of HCl, because the presence of the alkaline chlorides decreases very materially the delicacy of the test.

The object of adding calcium carbonate is two-fold. It precipitates the iron; and it creates a condition of uniformity as to the neutrality of the solution which is very essential for comparative results.

It is desirable that all the filter-papers used in a series of tests be of uniform size and quality of paper, so that they may retain a uniform amount of the rock-solution.

The method of adding the reagents is important, and should be closely followed.

After trying various methods, the one given above has been found to give the most satisfactory results, both as to delicacy and reliability. It is, of course, essential that the potassium hydrate contain no carbonate, and it should therefore be occasionally tested with barium hydrate or with a solution of lime in sugar.

The magnesium hydrate precipitate frequently comes down with a greenish color. The cause of this is uncertain; but it is most prominent in those samples containing organic matter. Possibly it is due to a trace of ferrous iron produced. This color causes the precipitate to appear somewhat more dense and opaque, and, therefore, should be allowed for in making comparisons. With a little practice this is not difficult, particularly if the comparison is made by transmitted light.

The scheme outlined above does very well for rocks carrying up to 4 per cent. of magnesium oxide. Above this, the precipitate gets too dense for comparison without further dilution.

It is desirable that the pipettes should be made from glass tubes of different sizes, and that short pieces of rubber tubing should be attached as mouth-pieces.

All of the apparatus can be conveniently packed in a box of the inside dimensions of 10.5 by 7 by 6.75 in.

A double top, in the form of a shallow box, of a size to fit snugly in the larger one, may be used as a convenient receptacle for the test-tubes, serving by means of auger-holes as a test-tube stand.

Small splinters from the larger pieces making up the permanent sample may be taken for this examination, and can be crushed without danger of loss by direct pressure and a grinding motion rather than by blows.

Such small pieces, if treated with dilute acid in a test-tube, will usually disintegrate entirely if the carbonate of lime is considerably in excess of the theoretical requirement, thus indicating the need of the admixture of clay or shale for the manufacture of cement.

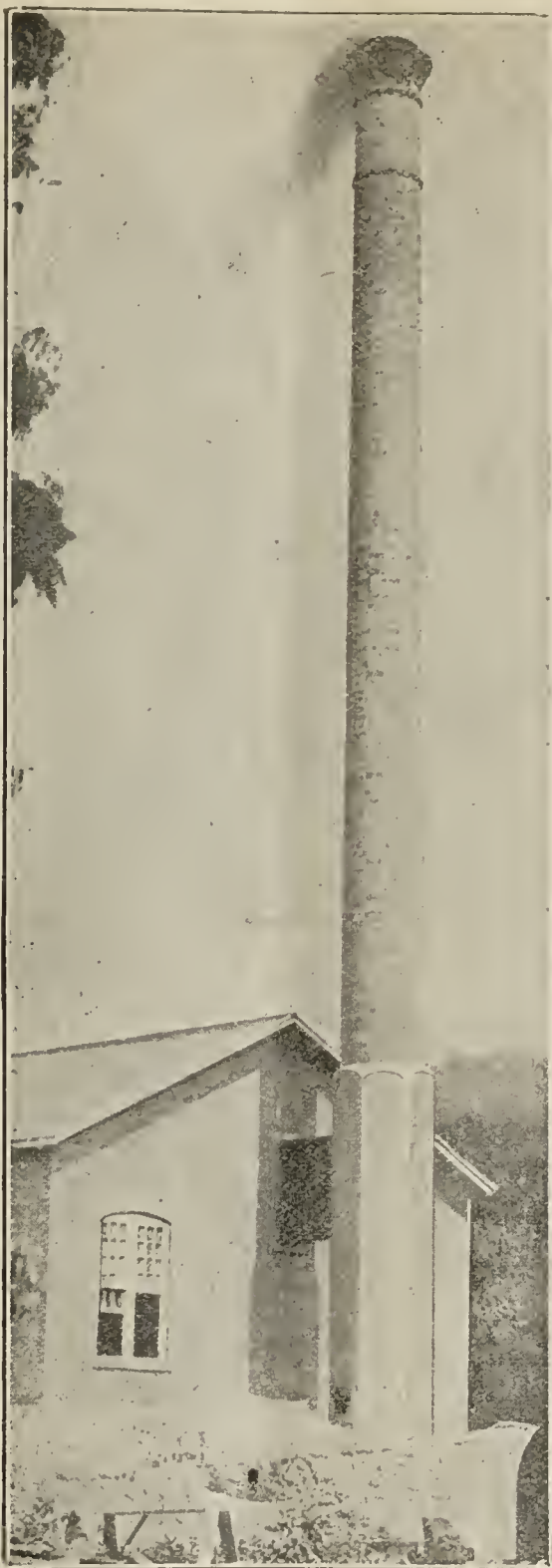
If the action of the acid ceases before all of the carbonate is dissolved, and recommences when the splinter is rubbed so as to remove the clayey covering, the stone is apt to need the addition of purer limestone to produce a satisfactory mixture.

If the splinter retains its shape when treated with dilute acid, but all of the lime carbonate is dissolved, the stone probably approaches closely a natural Portland-cement mixture.

Enter your machinery for exhibition at the 4th annual convention of the National Association of Cement Users Convention at Buffalo, N. Y., January 20 to 25 inclusive.

CONCRETE CHIMNEY STACK.

The Construction of reinforced concrete chimney stacks has had a wide application in this country and in Europe. We illustrate a chimney constructed of concrete blocks combined with reinforcing members. The stack is 120 ft. high carried on a foundation 18 ft. square, carried down 8 ft. below grade. The octagon base was constructed in place in forms with heavy reinforcement. The portion above the octagon is laid up with special formed blocks with reinforcing rings between each course of blocks. These rings are wired to the upright reinforcing members which extend



Cement chimney stack 120 ft. high.

from the base of the foundation to the top of the stack. The horizontal and perpendicular rods are wired to each other at short intervals; the interior diameter of the flue is 4 ft. and is fire brick line to the height of 45 ft. The Pettyjohn Machine Co. of Terra Haute, Ind., furnished the machine in which these blocks were made. The stack was built for the Standard Oil Company at one of its oil pumping stations. Some 16 Pettyjohn machines are employed on the Standard Oil pumping station work. The contractors are constructing 27 pumping stations for the Standard Oil Company and other pipe line companies, employing 34 Pettyjohn machines on the work. Under favorable conditions it takes 60 days to build a stack at the rate of two feet per day. Bad weather conditions encountered during the construction of the above described stack required 35 days to complete.

REINFORCED CONCRETE BEAM TESTS.

Bulletin No. 14, Tests of Reinforced Concrete Beams, Series of 1906, has just been issued by the University of Illinois Engineering Experiment Station. The tests described are a continuation of the tests discussed in Bulletin No. 4. The topics investigated include the effect of quality of concrete upon the strength of beams, the effect of repetitive loading upon the action of beams, and the resistance of beams to diagonal tension failures. The results of the investigation of diagonal tension failures throw light upon the amount of the vertical shearing stress which may be allowed in reinforced concrete beams not having metallic web reinforcement. The resistance of beams to diagonal tension may be the controlling feature of relatively short beams, and as such failures occur suddenly and without much warning, a knowledge of the resistance of the concrete is essential. Some beams gave surprisingly low values and it seems evident that the values allowed by many city building ordinances are higher than should be recommended. The tests of concrete columns and of reinforced concrete T-beams for 1906 have already been published.

CONCRETE BLOCKS 55 YEARS OLD.

Richard Staples of Rock Falls, Whiteside, Co., Ill., while excavating for a new building discovered an old foundation made of cement blocks made by a German workman 55 years ago who made a regular business of manufacturing these blocks in 1852 and selling them to farmers in the vicinity. Being a stone mason the German workman would often build cellar walls with his product for his customers. The method of manufacture was as follows: a trench was dug in the ground of the width of the block required. This trench was then filled with concrete while the concrete was still green, it was cut into the desired lengths with a spade and permitted to cure and harden. The blocks in this old foundation were 12 inches long, 6 inches wide and 4 inches thick, and were in good shape and form and would not absorb water; they were made of Utica cement.

The Dewey Portland Cement Co., of Dewey, Oklahoma has started up.

HERBST ARMORCRETE TUBULAR FLOOR CONSTRUCTION.

A new system of floor construction has been introduced in Europe known as the Herbst Tubular floor system. It consists of alternate webs and tubes. The webs are laid across the floor span from wall to

building site of the following mix: 1 part portland cement, 2 parts gravel, passing 3-8 inch mesh, and one part sand. The hollow concrete tubes are formed in short sections in a hand press after the following mixture: 1 part portland cement, 7 1-2 parts coke breeze, and 5 parts sand.

The coke breeze reduces the weight of the tube sections, have a rabbit on each side which serves to support the tube of the offset of the web. In from two weeks to a month after being formed the webs are assembled as shown in Fig. 1; concrete is then deposited between the webs

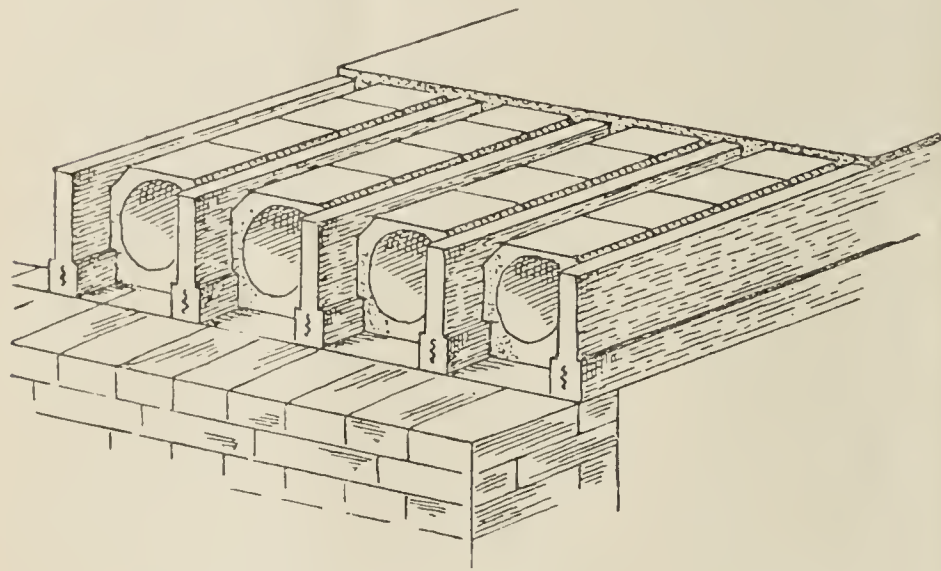
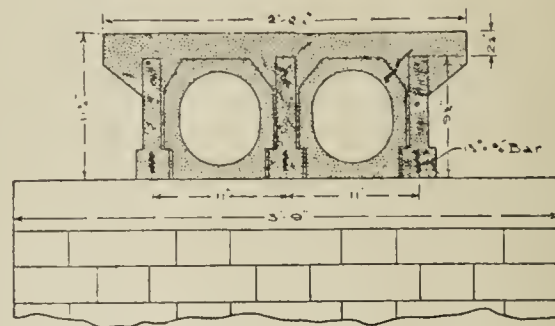
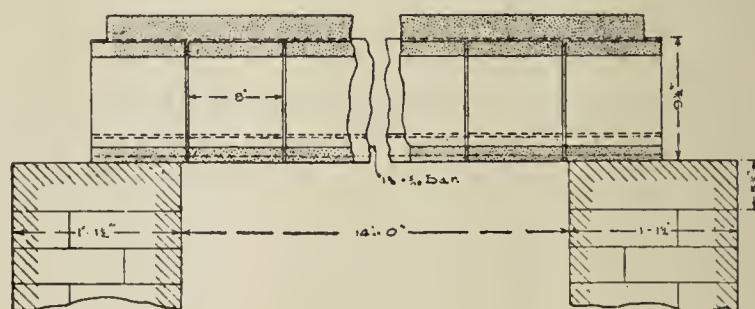


Fig. 1.

wall or other intermediate support, and spaced to receive the tubular sections; the object being to entirely dispense with false work in constructing a concrete floor. The webs are in the form of an inverted T reinforced with one or more corrugated bars, as shown in Figs. 1, 2 and 4. These bars in a web 9 1-2 inches deep are 5-16 inches thick, and 1 3-4 inches deep, and are placed about 1 inch above the lower face of the web which is 3 inches wide at the base by 1 1-2 inch at the top. The web is formed in wooden molds on the



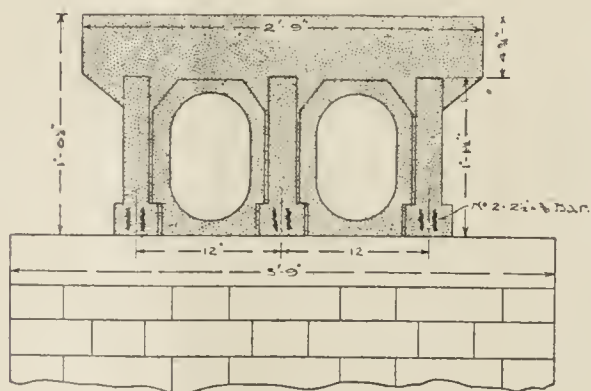
CROSS SECTION



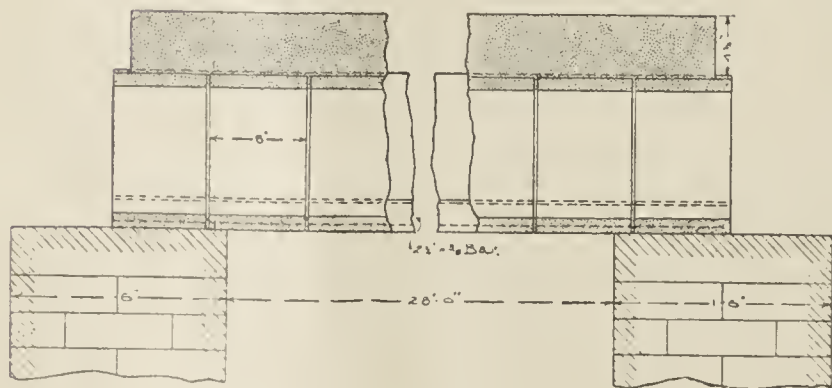
LONGITUDINAL SECTION

SLAB-A

Figs. 4 and 5.



CROSS SECTION



LONGITUDINAL SECTION

SLAB-B

Fig. 1 and 2.

over the tubes, and finished in one continuous slab. Fig. 6 is a test piece composed of these webs and two tubes with a 2 1-2 inch slab covering formed of 1 part portland cement and three parts gravel which gave a finished floor 11 3-4 inches thick. This test piece has a 9 inch bearing at each end on brick piers, 14 ft. span. Fig. 7 shows the same test piece under a load of 857 lbs.

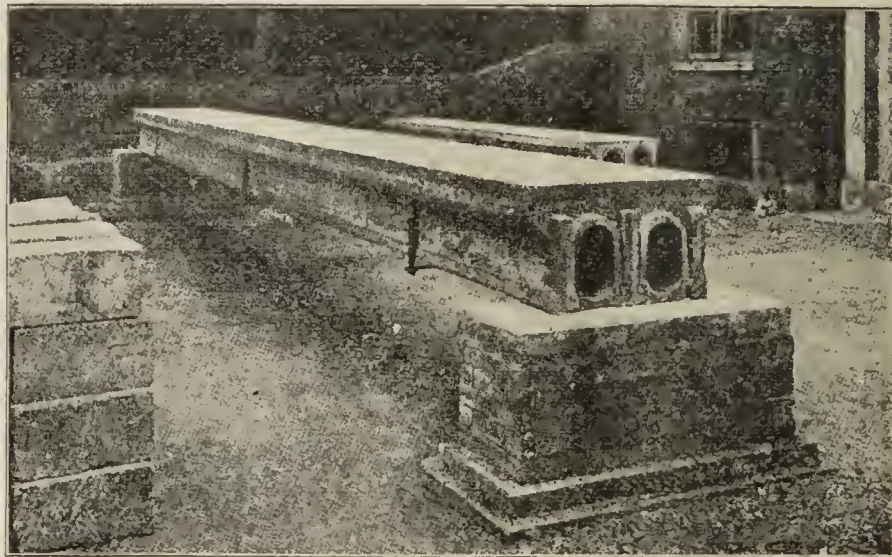


Fig. 6.



Fig. 7.—Slab loaded with 857 lbs. per sq. ft.

per sq. foot. The Herbst system of floor construction was tested by the British Fire Prevention Committee by submitting a Herbst slab under a load of 250 lbs. per sq. ft. to a high temperature fire test for 4 hrs. followed by the application of a stream of water from a fire engine for five minutes and was classified as a full fire protection. The economy of the Herbst system is due to dispensing with all false work.

The vacant property surrounding the city of Detroit, has been laid out into city lots, improved with cement walks, the only use found for this land are for pasturing cows. These animals break the walks down in crossing them and put the city and vacant property owners to much expense for repairs and rebuilding.

EDISON CEMENT HOUSES.

H. F. Sicbbe, Iowa State Architect, addressed a letter to Thomas A. Edison, stating that physicians contend that cement buildings would be unsanitary on account of storing up moisture. The following reply was received:

"Henry F. Liebke, State Architect, care Board of Control, Des Moines, Ia.—Dear Sir: In reply to your letter of the 4th inst., I beg to state that I have taken precautions about dampness and have kegs made of cement and filled with water to observe the rate of loss of water by porosity. The variations are immense, according to how the cement is made. I am also

observing the rate of penetration of water soluble dye colors.

"I think the doctors refer more particularly to block built houses, using a damp cement. The porosity of these blocks is very great and they are not suitable for dwellings. Very truly yours,

"Thomas A. Edison.

"The Laboratory of Thomas A. Edison, Orange, N. J."

The Louisville Commercial Club, of Louisville, Ky., will send a delegation to the Buffalo Meeting of the National Association of Cement Users, in the hope of inducing the association to select Louisville for its next meeting place.

The Omega Portland Cement Co., has closed for the winter.

The bids for the reinforced concrete bridge over the Arroyo de Los Paso, at Macy st., Los Angeles were as follows: Union Iron Works, \$51,786.75; Mercereau Bridge & Construction Co., \$58,313.50; F. O. Engstrom Co., \$58,330.15; C. Leonardt, \$59,352.25; W. N. Concanon, \$59,639.25; Atlantic, Gulf & Pacific Co., \$61,407.30; Robert Beyrle, \$67,073.95; The Midland Bridge Co., \$77,215.24.

The National Association of Cement Users Exposition at Buffalo, N. Y., January 20 to 25. Don't miss it.

THE FULLER-LEHIGH PULVERIZING MILL.

The Lehigh Car-Wheel & Axle Co. office and works at Fullerton, Pa., has issued and is circulating a 45 page catalogue describing the Fuller-Lehigh Mill, with numerous illustrations showing the mill installed and in operation as preliminary grinders and in clinker grinding, with floor plans and elevations reduced from actual working drawings, either motor driven or from line shaft, and belts driven in both cases. The mill is shown as set up fully housed and with the housing removed showing the interior parts each part being numbered by letters or figures or both so that he who runs it may read and understand the construction and operation of the mill. The illustration and description of the mill and its parts are so complete that any mechanic will be enabled to take the mill apart and re-assemble the same with little or no trouble. A number of letters from Portland Cement Companies using the Fuller-Lehigh mill in their plants are included in the catalogue which state that the mills are entirely satisfactory for first class work at a minimum cost either on raw materials, clinker or coal grinding. The style of finish of the various types of mills are described in great detail. This catalogue is sent only to prospective purchasers.

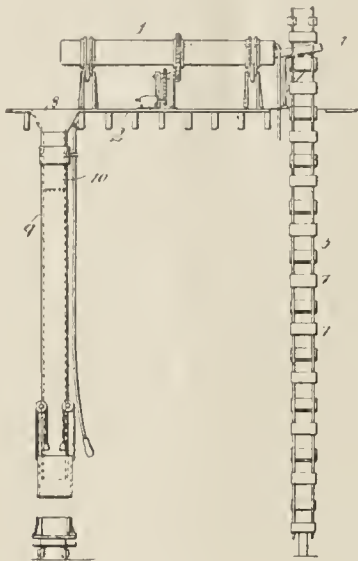
Write to Dai. H. Lewis, manager of the National Association of Cement Users Exposition, 760 Main St., Buffalo, N. Y., for space for your exhibit.

CEMENT MACHINERY CO.

Mr. Sid. L. Wiltse has purchased the machinery and good will of the Cement Machinery Co., of Jackson, Mich. Mr. J. C. Lautenslager is associated with Mr. Wiltse in the purchase. Mr. W. F. Cowham, heretofore in control of the Cement Machinery Co., has on account of his other extensive interests in the manufacturing end of the cement industry has sold out his interests in the Cement Machinery Co. The Cement Machinery Co. builds various kinds of machinery for the manufacture of cement, blocks, bricks, cement columns, cement post forms, etc. The company is one of the oldest in this line of business. All accounts payable and receivable from and after Dec. 1st, 1907, are accepted and retained by Mr. Cowham.

U. S. PATENTS RELATING TO CEMENT AND CONCRETE.

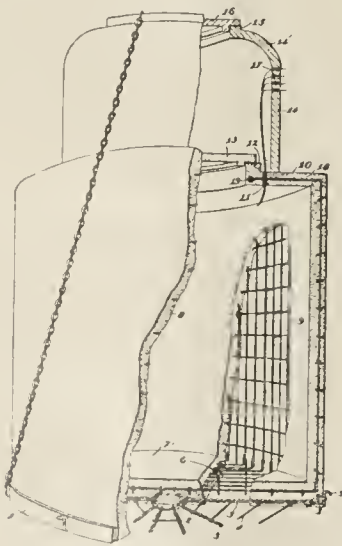
871,363. Concrete Mixing and Molding Apparatus. Charles R. Schmidt. Baltimore, Md. Filed Mar. 12, 1907. Serial No. 361,914.



No. 1.

2. A continuous mixing and molding apparatus, comprising a mixing tank, a plurality of endless conveyers arranged and adapted to convey the ingredients of the concrete mixture to the mixing tank in different proportions, a vertical chute through which the mixture is dropped into the molds, said chute being provided with a valved measuring chamber, and a vibrating grid or riddle substantially as described.

871,655. Reinforced Vault. Edward J. Winslow, Chicago, Ill. Filed Oct. 17, 1905. Serial No. 283,114.

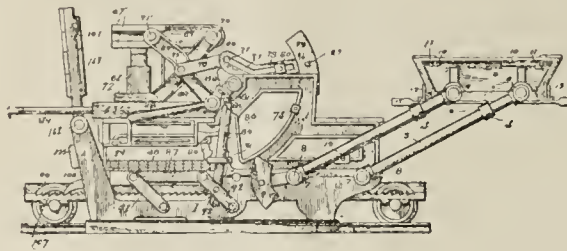


No. 2.

1. A water-proof vault comprising a main underlying chamber of substantially cylindrical shape and provided with a centrally located hatch-way in the top thereof, said hatch-way being provided with a removable cover, and a relatively high subsidiary cylindrical dome superposed upon said chamber and covering the aforesaid hatch-way, and grouted hermetically onto said chamber, said dome provided with

a top man hole and a removable cover therefor.

872,333. Concrete-Molding Machine. Lewis D. Ewing, Akron, Ohio. Filed Apr. 28, 1905. Serial No. 257,860.

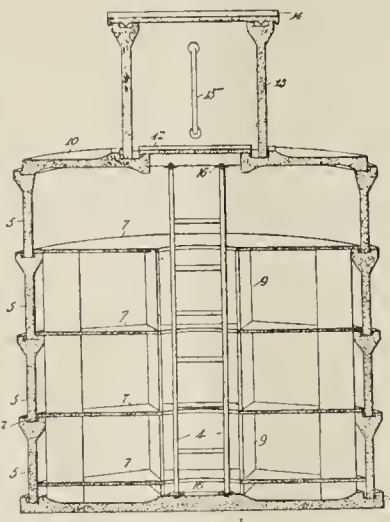


No. 3.

5. The combination with the mold box of a concrete machine, of a hopper having its sides adjustable and provided with extensible bottom plates, and adjustable supporting oscillating arms provided with balancing weights for swinging the hopper to and from the mold box.

(Claims 6 to 50 not printed.)

871,977. Sectional Vault. Edward J. Winslow, Chicago, Ill. Filed Oct. 20, 1905. Serial No. 283,585.

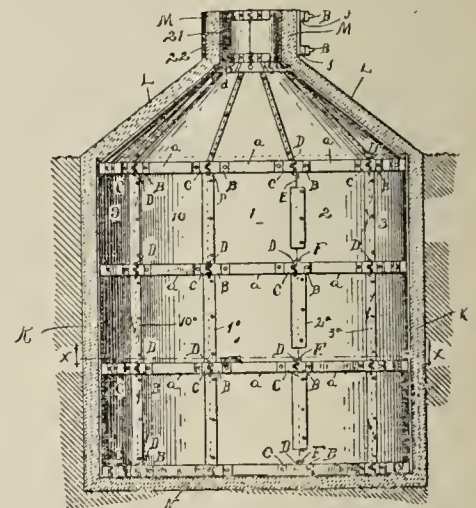


No. 4.

1. A water-proof vault comprising in combination, an imperforate main chamber of plastic material having substantially the shape of a right cylinder with horizontal plane top and bottom, a plurality of annular shelvings spaced vertically apart around the inner periphery of said main chamber, said shelvings being divided into a plurality of cells by radially disposed vertical partitions, a ladder extending from top to bottom of said chamber in the central space provided by said shelvings, said chamber top having a manhole eccentrically positioned with its perimeter adjacent the upper termination of said ladder, and a relatively large dome rising from said top and covering said manhole, said dome being provided with a manhole and removable cover in the rise thereof.

872,393. Form for Cement Cisterns or the Like. Howard E. Votaw, College Corner, Ind. Filed Sept. 26, 1906. Serial No. 336,240.

A form for making cement cisterns or the like, comprising a plurality of sections each formed substantially on the segment of a circle, said sections having ribs secured transversely to their inner faces and provided with means for flexibly connecting their adjacent ends, the adjacent ends of the ribs of a pair of said sections being spaced apart,

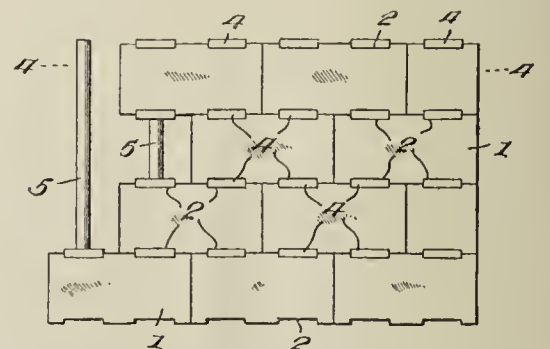


No. 5.

knuckle joint members secured to the inner sides of these ribs and projecting beyond but in rear of their spaced ends, pins connecting said knuckle joint members, seats thus being formed between the spaced rib ends and between the knuckle joint members and the inner sides of the form sections, and longitudinally tapering wedges adapted to be driven into said seats to expand the form.

872,364. Cement Block. James S. Pierce, Tacoma, Wash. Filed Sept. 24, 1906. Serial No. 335,987.

2. A wall formed of plastic blocks laid in superposed layers and each block formed with grooves upon opposite sides and openings with the

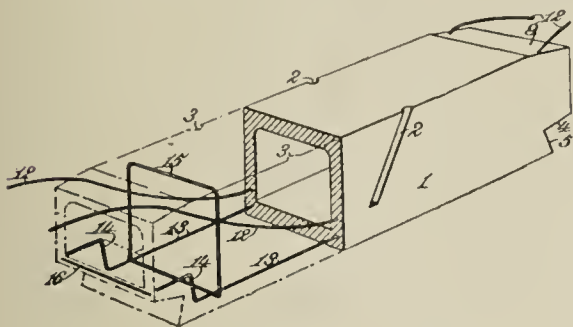


No. 6.

grooves and openings registered girders disposed in coincident registering grooves and disposed transversely of the length of the blocks, there and tie shafts passed through the openings of the blocks and coincident openings in said girders and extended at right angles to the girders, said blocks being laid to break

joints and the girders being parallel to each other and concealed from view.

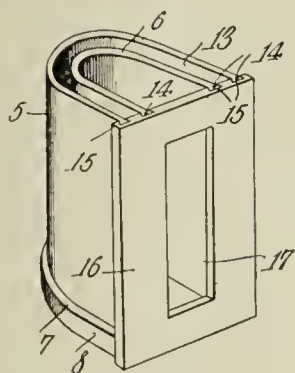
873,505. Hollow Building-Block. Benjamin Cerutti, Habana, Cuba. Filed May 15, 1907. Serial No. 373,812.



No. 7.

3. A hollow building block adapted to have its ends mounted upon supports and comprising a transversely extending frame embedded in the block and surrounding the opening at each end thereof in close proximity to the supports thereby reinforcing each end of the block, and longitudinally extending reinforcing members arranged in the bottom of the sides of the block and abutting against the bottom and sides of the frame to prevent lateral displacement of said members in one direction.

873,634. Concrete-Tile Mold. William S. Thomas, Eaton, Colo. Filed Mar. 18, 1907. Serial No. 363,080.



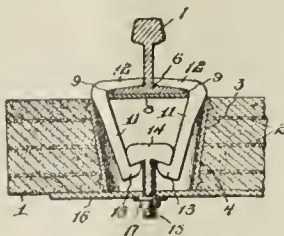
No. 8.

A mold including a vertically disposed supporting frame provided with spaced longitudinal dove tailed grooves, and substantially U shaped open ended shells having their longitudinal edges provided with corresponding dove tailed flanges adapted to slideably engage the grooves in the supporting frame and each provided at one end with a lateral off-set, the inner shell being spaced from the outer shell to form an intermediate molding compartment and having its exterior walls provided with an intermediate circumferential rib extending laterally within the molding compartment and having its opposite ends terminating flush with the in-

ner surface of the supporting frame, there being an elongated opening formed in the frame between the dove tailed flanges of the inner shell.

873,585. Rail-Tie. Louis R. Nordquist, Tampa, Fla. Filed Apr. 6, 1907. Serial No. 366,780.

4. A tie molded of plastic material and having an interior reinforce, said tie being formed with socket openings, socket pieces secured within the opening, a bridge plate

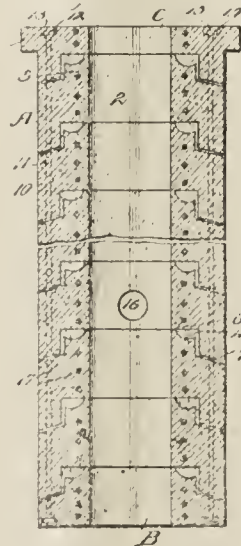


No. 9.

bridging the openings and terminally engaging the edges of the tie, locking bars having rail flange engaging portions, a bed plate arranged beneath the tie, and means co-operating with the bed plate and engaging the locking bars, said means engaging the locking bars wholly within the socket pieces.

869,518. Concrete Chimney. John W. Rector, Savannah, N. Y. Filed Sept. 19, 1906. Serial No. 335,291.

The herein described chimney composed of a plurality of concrete blocks, said blocks each having a central flue aperture, an upwardly extending flange surrounding said aperture, an inclined shoulder leading from said flange to the outer surface of the block, the flange being cut away along the top edge away from said aperture to form a

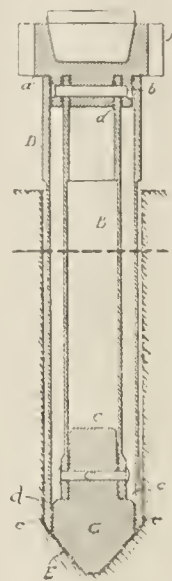


No. 10.

mortar receiving groove, a flange on the underside of said block of less strength than the first named flange and provided with an inclined under surface and a square shoulder inside the flange, wire rings embedded in the block and surrounding the flue aperture, and

longitudinal binding rods extending through the blocks.

869,336. Concrete Pile and Means for Driving Same. John Stewart, Pittsburg, Pa., assignor to The Simplex Concrete Piling Company, Washington, D. C., a corporation of the District of Columbia. Filed Feb. 15, 1907. Serial No. 357,471.



No. 11.

1. The combination of a preparatory pile, a driving form, a cap plate extending under the end of the driving form and the preparatory pile, said cap plate being detachable and remaining in the ground after the other parts have been withdrawn, substantially as described.

6. The combination of a driving form, a preparatory pile surrounding the driving form, said driving form having a tapered point, a sheet metal cap plate conical in form and conforming to the shape of the point, said cap plate being greater in diameter than the preparatory pile so that when it is driven into the ground its outer edge will be flanged and bear tightly against the outer walls of the preparatory pile forming a tight joint between the cap plate and the preparatory pile, substantially as described.

869,280. Means for Frost-Proofing Concrete Walls. John H. Walzl, Baltimore, Md. Filed July 19, 1907. Serial No. 384,669.

1. A composite wall comprising a vertical concrete body having embedded therein a plurality of longitudinally extending boards arranged in a vertical plane with respect to their longitudinal edges, the boards staggered or alternately arranged at opposite sides of an imaginary vertical line drawn through the center of the wall, spacing blocks interposed between each two boards and engaging their contiguous faces, and grounds countersunk in the inner face of the wall and having their outer faces parallel with

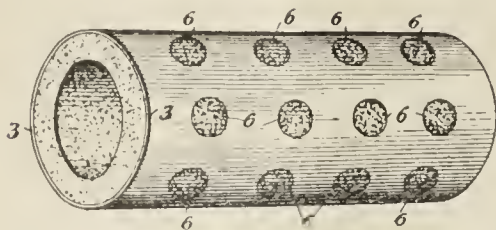
the vertical plane in which the inner face of the wall is formed and the inner faces of said grounds engaging the inner face or side of one of the boards.



No. 12.

4. A frost-proof, concrete wall, comprising a plastic body, boards arranged in staggered relation and embedded in said wall, each two boards overlapping at their contiguous longitudinal edges, wooden blocks interposed between the overlapping sides of said boards and plastic material interposed between the remainder portion of the overlapping sides, and said plastic material between the overlapping sides of the boards forming a bond for the plastic material at the outer faces of the boards.

869,266. Tile. John F. Schwartz, Alma, Mich. Filed July 30, 1907. Serial No. 386,262.



No. 13.

1. A tile consisting of a cement body, and an exterior layer of protecting material retained on the tile by the adhesive character of the cement.

4. A tile consisting of a cement body, and an exterior layer of paper or other suitable material permanently united with the cement body and provided at intervals with apertures for exposing portions of the outside cement.

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Come to the Buffalo Convention of the National Association of Cement Users and see the latest up-to-date cement machinery and products that will be displayed.

BOOK NOTICES.

Beton & Eisen, the International organ for reinforced concrete has heretofore appeared 12 times a year, but from and after January, 1908, will appear 16 times per year. The subscription price \$5.00 per annum will not be increased. F. Von Emperger, Civil Engineer, Editor. Wm. Ernst & Sohn, Publishers, Berlin, W. 66 Wilhelmstrasse 90, Germany. Beton & Eisen is the oldest reinforced concrete journal published. Most of the articles are in German, but occasionally articles appear in the English and French language. Subscriptions sent to the publisher will receive prompt attention.

Hotchkiss Directory of the Recognized Lumber Dealers and Mason Supplies of the State of Illinois. 163 pages 7 1-2 by 5 1-4 in. Paper cover. Price 25 cents. Published by Geo. W. Hotchkiss, 315 Dearborn St., Chicago, Ill.

This Directory has been revised up to Oct. 1, 1907, besides the regular list of dealers in lumber and mason supplies of the State, the directory contains the Illinois Mechanics Lien Law, the car service rules of the Ills. Car Service Association, the grading rules governing the various kinds of lumber.

With instructions of How to Use the Mechanics Lien Law, by Elmer H. Adams, attorney at law.

Everett W. H. Hogle, secretary of the Illinois Masons Supply Association, is associated with Mr. Geo. H. Hotchkiss, secretary of the Illinois Lumber Dealers' Association in the publication of the directory.

Reinforced Concrete Factory Construction, 230 pages, with 159 cuts and diagrams. Price \$1.00. Published by The Atlas Portland Cement Co., 30 Broad St., N. Y.

This is a practical treatise on the construction of reinforced concrete factory buildings, warehouses, under various systems of Ferro concrete, now in extensive use in this country. It is just such a book as the contractor is looking for to assist him in this class of work. The illustrations are reproductions of working drawings of structures actually built.

The size and spacing of the reinforcing bars being plainly marked in figures. The entire scheme of distributing and arranging the metal in the various beams girders, columns and floor being shown. Specification for cement and other materials entering into this form of construction are given, covering

each detail from foundation to the roof, in plain simple language.

The numerous buildings shown and described represent the best class of construction that have been erected in this country which at the same time shows the progress being made in reinforced concrete. The work includes description with details of tanks, piles, chimney construction. The price of \$1.00 is very low for this book considering the vast amount of valuable data it contains.

The National Association of Cement Users Exposition at Buffalo, N. Y., January 20 to 25. Don't miss it.

Iquitos, Perue imported, 2500 bbls., of cement in 1906, according to the report of United States Consul Eberhards at that port. Cement laid down at Iquitos cost from \$4.56 to \$5.56 per bbl, and retails at \$7.50 per bbl. of 400 bbls. Freight is much higher than from Europe; the cement trade is consequently in English and German hands.

THE NATIONAL ASSOCIATION OF SAND-LIME PRODUCTS.

The last annual convention of the National Sand-Lime Products Association was held at the Chittenden hotel, Columbus, Ohio, Dec. 4 to 6 inclusive. The association is composed of the representatives of 158 companies engaged in the manufacture of sand-lime products in the U. S. Some 40 members were in attendance on the first day.

The following papers were read:

The Essential Conditions of Manufacture for the Production of a Uniform Sand-Lime Product, by J. Harry Allan, Winchester, Ky.; The Power Plant, by T. M. Jackson, Saginaw, Mich.; Question for Discussion—To What Extent does Efflorescence Appear on Sand-Lime Products in General and what Remedies have been Applied?

Official Staff.

The officers of the association are: President, H. O. Duerr, Wilmington, Del.; vice president, Clark Mellen, Colorado Springs, Col.; treasurer, William King, Cedar Rapids, Ia.; secretary H. de Joannis, Chicago, Ill.; executive committee, J. L. Jackson Saginaw, Mich.; George W. Bostwick, Michigan City, Ind.; W. J. Carmichael, Wiloughby, Ohio.

Mr. H. de Joannis is also the publisher of "The Brick," the national journal of brick manufacturers of the country.

MIRACLE EXHIBIT OF THE CHICAGO CEMENT SHOW.

An eye opener at the Chicago Convention was the Miracle booth. This firm demonstrated fully that they are not only keeping up with, but advancing a little ahead of the times with concrete products and equipment. They show great improvement in their brick and block machines and also show samples of the fancy molds formerly manufactured by the Cement Working Machinery Company of Detroit, which they recently purchased, and to which they have largely added.

Perhaps the most interesting and newest departure in the concrete line, which they were explaining and which they assured us will be on exhibit at the Buffalo Convention, were the tombstone molds. They have all kinds and all sizes for their manufacture and the products of these molds are certainly pleasing to the eye and will surely find a ready market anywhere.

The sewer pipe molds, while not a new thing, attracted their share of attention, and the remark was often heard from bystanders that this was a line that they would certainly add to their plant.

In talking with the various representatives of this enterprising firm during the convention, they all expressed their pleasure at the interest taken in their exhibit and as invariably one of them had the order book and pencil in hand and from the smiles that lit up their faces, the writer took it that they were booking very nice orders in their spare moments. This was afterwards verified by one member of the firm, who said they had taken more orders at the Chicago Convention than at any previous gathering.

They extend a cordial invitation to all who contemplate visiting the Buffalo show, to send their mail in their care, leave their grips at the Miracle booth and in fact, make the Miracle booth headquarters during their stay in Buffalo.

THE NORTHWESTERN CEMENT PRODUCTS ASSOCIATION.

This association came in a body to Chicago and held its annual convention at the Chicago Cement show and was in charge of the convention end of the exhibition. The following program was presented.

DECEMBER 18TH.

Morning Session.—Meeting called to order by Col. Lee Stover, President, Watertown, S. D. Address of Welcome to the Northwestern Cement Products Association, Edward M. Hagar; Res-

ponse, Lee Stover; Paper: The Status of the Cement Industry in Iowa, R. G. Coutts, Grinnell, Iowa; Paper: Practical Suggestions for a Concrete Block Plant in a Small Town, Ed. Smith, Barron, Wis.; Paper: Use of Concrete and Cement Block on the Farm, Henry E. Murphy, Manitowoc, Wis.

Afternoon Session.—President's annual address, Col. Lee Stover, Watertown, S. D.; Lecture: The Effect of the San Francisco Earthquake and Fire on Structures and Structural Material, (by special request) Richard L. Humphrey, Philadelphia; Paper: The Use of Concrete and Concrete Pipe as Applied to Irrigation, E. T. Perkins, Engineer Reclamation Service, Chicago; Lecture: The Concrete that Made Milwaukee Famous, J. P. Sherer; Discussion (Open to everybody).

Evening Session.—Lecture: Concrete in Pabst Country Place at Oconomowoc, R. E. Newton, Milwaukee; Lecture: Concrete in Lincoln Park, Chicago, F. L. Simmons, President Lincoln Park Board, Chicago; Discussion (Open to everybody).

DECEMBER 19TH.

Morning Session.—Paper: Caps, Sills and Other Special Work, Eugene Teutsch, Minot, N. D.; Paper: Forms, Ernest McCollough, Chicago; Paper: Construction of Concrete Sidewalks, A. B. Pederson, Hankinson, N. D.; Discussion (Open to everybody).

Afternoon Session.—Lecture: Concrete Blocks, S. B. Newberry, Sandusky, Ohio; Paper: Manufacture of Cement Pipe, H. J. Klemme, Belmond, Iowa; Paper: General Uses of Cement Pipe, L. L. Bingham, Estherville, Iowa; Illustrated Lecture: The Advance in Reinforced Concrete Construction, C. A. P. Turner, Minneapolis; Paper: Cement Pipe as Used for Drainage and Irrigation, F. A. B. Patterson, Fairmont, Minn.; Discussion (Open to everybody).

Evening Session.—At Lexington Hotel, cor. Michigan avenue and 22nd street: Executive Meeting; Report of Martin T. Roche, Secretary, and J. M. Hazen, Treasurer; Auditing Committee; Election of Officers for the ensuing year.

INCORPORATED.

The Hollow Concrete Pole Co., of Oklahoma City, Okl., has been incorporated with a capital stock of \$50,000 by F. H. Tidmar, H. W. Graves, William B. Denn, and a number of others.

Armerter Beton, a new monthly Journal devoted to the theory and practice of reinforced concrete construction, by E. Probst, civil engineer, W. Prayer Strasse, 2 Berlin, Germany.

The directors of the American Cement Co. have declared a regular semi-annual dividend of 3 per cent, payable Jan. 23 to stock of record Jan. 11. The usual custom has been to pay in addition an extra dividend of 1 per cent, but the board considered it a conservative move not to make an extra distribution at this time.

The cement and lime output of Missouri for 1907 is computed at \$9,000,000. Prof. E. R. Buckley, state geologist of Rolla, Mo., compiled the statistics for these commodities. Prof. Buckley has resigned his position as state geologist. The resignation has not yet been accepted.

The Bonner Springs cement plant at Bonner Springs, Kans., is to start up Feb. 1, 1908.

General Concrete Construction Company, Shelby County; capital stock, \$10,000; incorporators, Carl Steiler, W. F. Kachler C. E. Davis, M. F. Hennas and G. J. McSpadden.

C. W. A. Armour, of Ft. Smith, Ark., can give information concerning the establishment of a concrete works, at this place, at a cost of \$150,000 by Kansas City (Mo) capitalists.

Western Concrete Bridge Company, \$10,500; engineering and contracting business. L. W. Riddle, A. Maldaner, J. T. Richards.

Come to the 4th annual convention of the National Association of Cement Users Convention at Buffalo, N. Y., January 20th to January 25th, 1908.

The power house of the Virginia Portland Cement Co. at Frederick, Va., was wrecked on Dec. 14, just as the men were leaving their days work. When a steel girder supporting the roof fell demolishing one of the brick walls which fell onto the two 2,000 H. P. engines and several smaller engines, causing an indefinite suspension, until the building is again repaired. A few workmen received slight injuries.

The Railways have made a special rate of one and one third fare, plus 25 cents for round trip to the National Association of Cement Users Convention, at Buffalo, January 20th to 25th inclusive.

Mr. Douglas H. Gibbs, England, a director of the Associated Portland Cement Mfrs. (1900) Ltd. Mr. Gibbs called at the office on Dec. 20, and said he had come from California especially to visit the Chicago Cement show. Mr. Gibbs is very much interested in the development of the American cement industry.

Come to the Buffalo Convention of the National Association of Cement Users and see the latest up-to-date cement machinery and products that will be displayed.

The United States Circuit Court sitting at St. Paul has handed down a decision in the case of W. F. Webb, vs. the American Asphaltum & Mining Co. Mr. Webb having located a placer claim in Grand County, Colo., on a deposit of Asphaltum found in rock fissures. The American Asphaltum and Mining Co., located a load claim on the same property and ousted Webb. The Court held that a load claim was proper was proper and valid against a placer claim.

The Alpha Portland Cement Co., will be shut down on Dec. 24th about 500 men will be laid off.

The Chicago Portland Cement Co. will shut down, while the new and enlarged section of the plant is connected up with the old portion which can only be done during a complete shut down.

The plant of the Great Northern Portland Cement Co., at Marlborough, Mich., is to be sold to satisfy a mortgage originally for \$600,000, now amounting to \$657,781.87, under an order of sale issued by Judge Swan of the U. S. District Court.

The Edison Portland Cement Co., will shut down the limestone quarries leased from Charles C. Cox at Sparta, N. J. The machinery at the quarry is being removed to Buttsville, N. J., where the company has opened up a new quarry giving a shorter haul to that plant.

The Egyptian Portland Cement plant at Egypt, Mich., has shut down.

The Sandusky Portland Cement plant at Dixon, Ill., has shut down. It will open for the spring trade with 30,000 bbls., on hand to meet the light trade conditions during the winter months.

The Union Lime & Cement Co., of Utah has brought suit against the U. S. Smelting Co., for \$70,000 on account of breach of contract in not delivering limestone to the cement company as per contract.

Mr. Ellis Soper of the Hunt Engineering Co., read a paper before the Vanderbilt Engineering Association of Chattanooga describing the

Dixie Portland Cement plant at Copenhagen, Tenn.

The Freeborn Construction Co. of Kansas City, Mo., has secured a contract for the erection of the Humboldt Portland Cement Co., plant at Humboldt, Kan.

CAST CONCRETE HOUSES.

There has recently appeared, in Cement and Engineering News and other journals, a description of a new method of casting concrete houses in a single piece, invented by a scientist whose name is universally known. Cast iron molds, accurately fitted and planed, for the whole house, are first made at a cost of about \$25,000 per set. These are very carefully fastened together so as to make a complete double skeleton of a house, and into the space between them concrete, composed of one part cement, three parts sand, and five parts crushed stone, is to be pumped. All ornamental and useful fittings are cast in place, so that, when the molds are taken away, one has a perfect monolithic house complete in all respects.

It is stated that the concrete must be pumped in very slowly, and the molds removed in seven days after the house is complete. The wear and tear on the molds per house is estimated at \$50, and the total cost of the building at something like \$1,200.

All this sounds very attractive, but careful consideration points out several difficulties which do not seem to have been considered by the inventor.

A complete set of concrete molds costs \$25,000, and will produce only one house of one size. This house will fit only a lot of a certain size, and cannot be expected to suit every purchaser. It is manifest that, to carry on such a business successfully, a very large number of complete sets of molds, adopted to make houses of different sizes and styles, must be provided to suit the varying taste and ability of purchasers. Fifty complete sets would not be an excessive amount to start with, and these would cost \$1,250,000.

To erect the full set of molds into the form of a house, with the necessary care, would take a long time, and a large amount of labor. To remove them after the concrete has hardened would take further time and more labor. It is not impossible that the total labor, expended in erecting and taking down the molds, would be equal to that

required for the erection of an ordinary concrete house, if it did not exceed this.

The time required for erecting all these molds, pumping them full of concrete, and taking the molds down and removing them to the site of another building, would be so great that probably no more than ten houses would be made from each set of molds per year, even if there were a demand for all the houses of that particular style and size which could be furnished, which is at least doubtful. The mere interest on the cost of a set of molds would be \$1,500, per annum, which must be divided among ten houses, making the interest cost \$150 each.

It is more than likely that a mixture containing so large an amount of crushed stone would not flow thoroughly everywhere, so that, when the molds are removed, empty spaces and imperfections would certainly be found, and these would have to be finished with the expenditure of a large amount of time, labor and money.

It is commonly known that massive concrete, without division or seams, is sure to develop shrinkage cracks in drying out. These are not serious in heavy work, such as piers, abutments, etc., but the injury to the appearance of the finished work would be a very serious matter in dwelling houses.

There are other objections which I need not now enlarge on, but those already cited seem sufficient to show that the various elements of expenses and contingencies, attending the proposed method of construction, have been so little considered, that the statements of expense given in the publications are grossly misleading and untrustworthy.

Concrete is an enormously valuable material, and its application to new uses is constantly increasing. All persons interested in its manufacture are injured, when claims are made for the material or methods suggested for its use, which results must show to be improper.

A. S. J.

WANTED.

Position as manager or Asst. Mgr. of cement mill—10 yrs. experience in designing, building and operating plants. Thorough knowledge in all branches. At present employed as superintendent. Would change, account bad climate. Best references.

Address A. C., of Cement and Engineering News.



Have You Read the Story of King Portland?

It comprises one of the most Interesting Chapters in our Commercial History.

Synopsis:—

A few short years ago the Workers of Wood looked in vain to the North, to the East, the South, and the West, for a Visible Supply of Lumber.

The Steel King came to the rescue in a manner.

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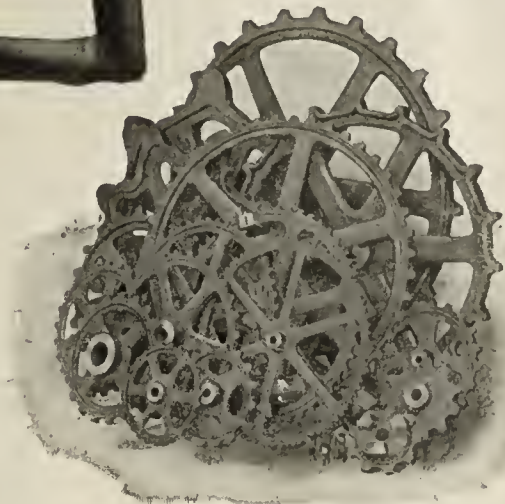


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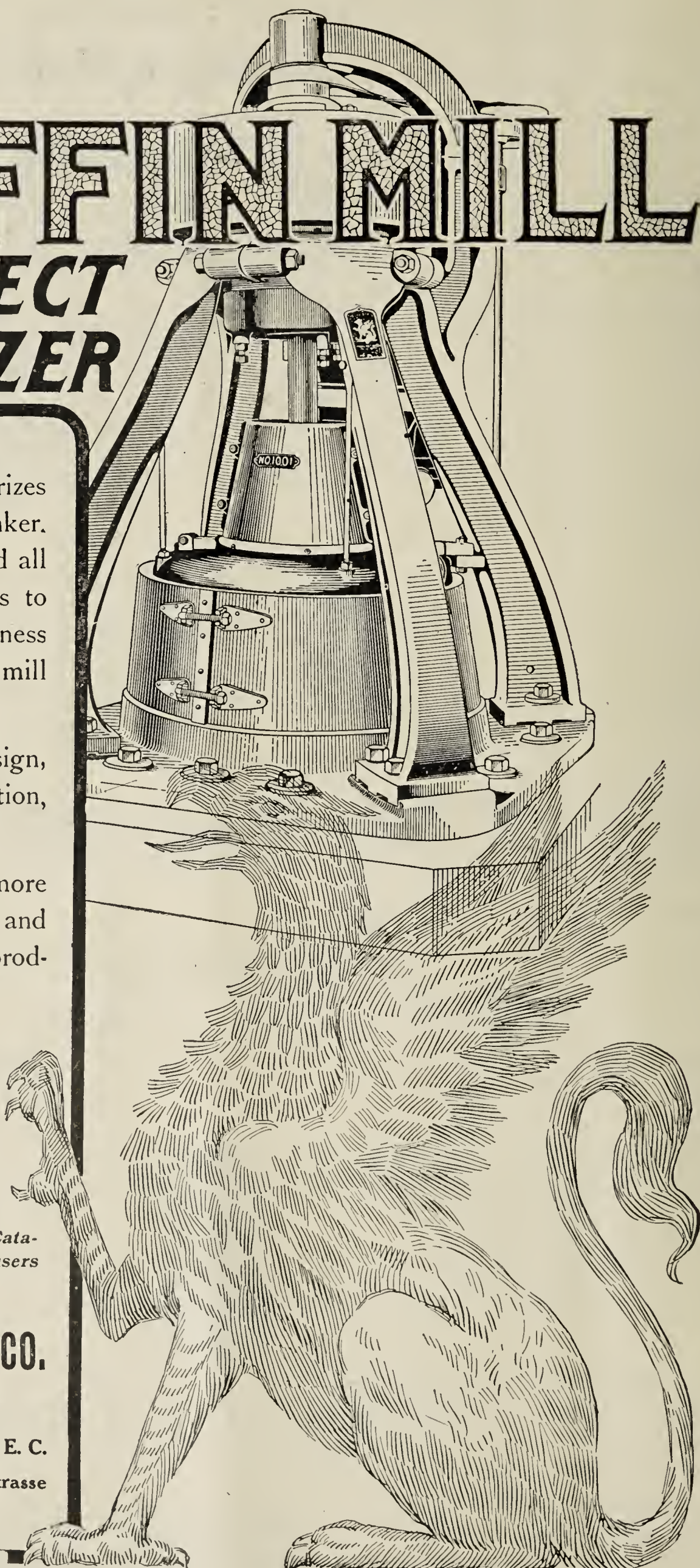
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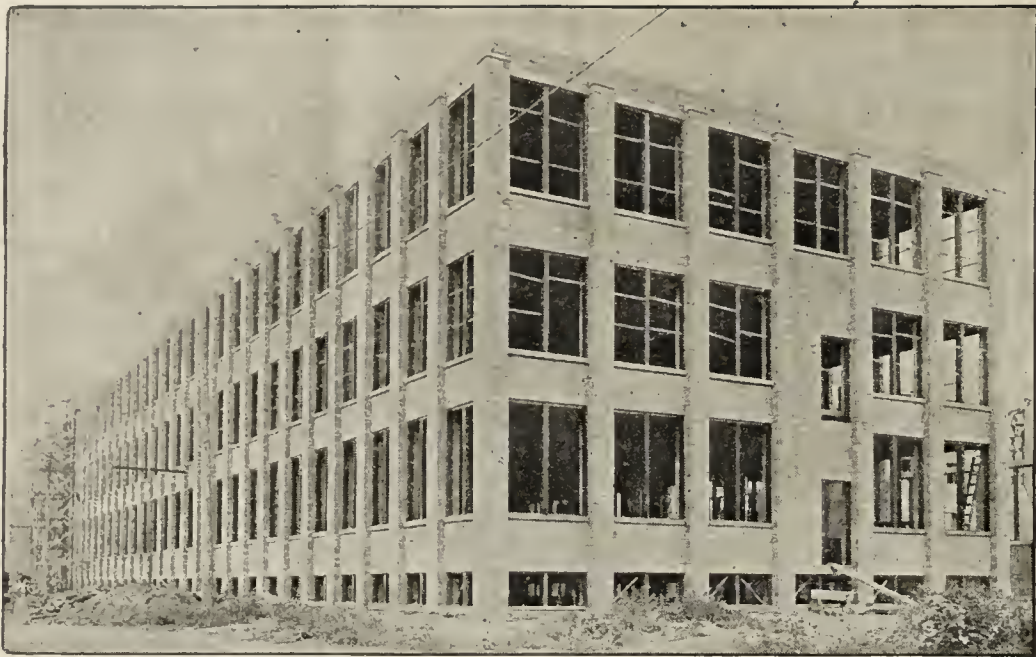
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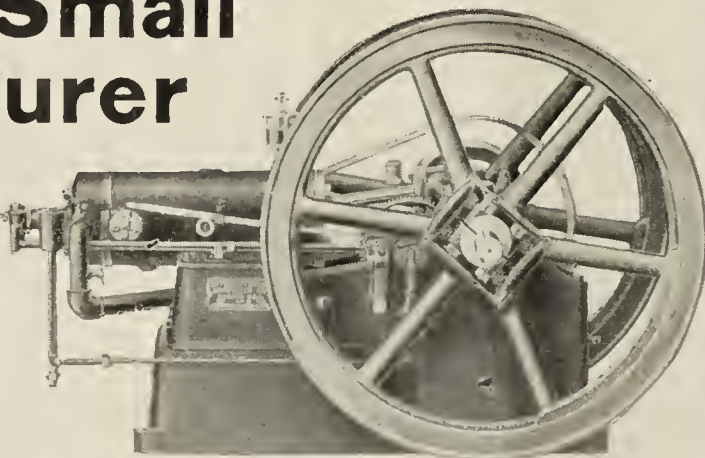
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CORRESPONDENCE.

We solicit correspondence on all matters of general interest to the cement trade in all its branches. Engineering notes, public improvements, and facts and opinions drawn from practical experiments will be welcome.

THE OUTLOOK FOR 1908.

The present depression in the building industry which has gradually gone from bad to worse during the last five months of 1907, is still upon us. There is a deep seated feeling in the minds of many manufacturers, that this depression will extend to a greater or less extent into 1908. We think differently, however. We confidently look for and expect a large volume of business in the cement industry during the approaching season of 1908. Architects have fully as much work on their boards as last year, running more to cement construction than in the past. It looks as if cement were to have a monopoly in building construction in the near future. Cement and concrete construction is a live subject. One hears it talked of in the cars, restaurants, theaters, real estate offices. Everyone wants to build in cement. Our telephone is constantly ringing up for information on the subject. Our mail is likewise full of requests for information in the same line. The cement block manufacturers tell us they have never before had so many requests for figures as during the past three months; everything looks encouraging to them. Go to the book stores and news stands and they will tell you, that they have more inquiries about cement and cement construction than any other line.

Reinforced concrete, engineers and contractors are figuring on more work than ever before. All this points to a boom for the coming year or season, for cement construction. The daily and weekly newspapers have been at work educating the people to appreciate the merits of concrete as a building material; all of which helps the industry along, by way of free advertising. The prospective builder is now looking for definite information on practical lines for the purpose of investing his cash in concrete building constructions.

This will have a beneficial influence on the demand for cement for purposes of concrete construction.

Iowa Association of Cement Users will hold its fourth annual convention and exhibition at Hotel Savery, Des Moines, Iowa, February 19th, 20th and 21st, 1908. Space for exhibits can be had in the Hotel at the rate of 10c per sq. foot, with a minimum charge of \$5.00 by addressing Ira A. Williams, Sec'y. Ames Iowa, or to the Manager of Savery Hotel, Des Moines, Iowa. Space for machinery in operation is to be provided on the ground floor, near the hotel. Iowa is one of the largest manufacturers of cement products, having produced over \$500,000 worth of cement ware in 1906. This with sidewalk and street foundations runs up to over \$1,500,000 for the same period. The Iowa Association of Cement Users' Conventions in the past have been largely attended by purchasers of machinery. The papers read have been first class and to the point, in our opinion, no one should miss the next meeting, who is interested in the use of, or sale of cement and machinery used in the production of cement and concrete products.

Macadam roadways in France under government control, are being treated with hot coal tar diluted with 10 per cent of oil, at a cost of four tenths of a cent per square yard. The results are said to be excellent.

The Marquette Cement Co. of Chicago and La Salle, Ill., will run its plant all winter filling government contracts for cement, as well as large orders from railway companies.

NORTHWESTERN CEMENT PRODUCTS' ASSOCIATION.

Martin T. Roche of St. Paul was chosen president of the Northwestern Cement Products' Association. The list of officers are as follows: Vice-presidents, H. E. Murphy, Manitowoc, Wis.; O. U. Miracle, Minneapolis; A. E. Laughlin, Lisbon, N. D.; Col. Lee Stover, Watertown, S. D.; secretary, J. Van Dorn, Minneapolis, and treasurer, J. M. Hazen, Minneapolis.

Invitations for the convention of the association next year were presented by Minneapolis, Fargo, N. D.; Watertown, S. D., and Mason City, Iowa. The final choice of time and place was left to the executive committee, with power to act and make all necessary arrangements. It seemed to be the general feeling among the men in the convention that the invitation of Minneapolis should be accepted, inasmuch as it had been originally planned to hold the present meeting in that city, and in view of the liberal offer made for the next meeting.

RED IRON STAINS FOR CEMENT BLOCKS AND FLOORS.

It is often desirable to be able to produce a red or iron colored cement block or concrete factory floor. This can readily be accomplished, as follows: sprinkle sawdust over the floor to the depth of one half inch; next scatter iron filings over the surface one ounce to the square yard and over this spread one inch deep wood shavings. Make a solution of sal-ammoniac one pound to 6 quarts of water; sprinkle the floor and keep moist for several days. The sawdust and shavings can be used over and over again. This preparation is said to produce a high degree of water-proofing. The shavings are not absolutely necessary and are only used to prevent evaporation for cement blocks, a cement basin 10 by 20 ft. raised four inches at the sides may be used. Cover with one inch of sawdust and use the same mixture, noting that the greater the quantity of iron used the darker the stain produced. The tank or basin should be flooded to the depth of stain required on the face and sides of the blocks. The longer the block remain in the solution the darker and more dense the stain and the more water proof it will become.

This is not new or patentable as it has been used for years in Europe. Ironite which is being made as a waterproofing is substantially the same compound. Iron dissolved by sal-ammoniac and used as a paint.

A RAILWAY THAT GOES TO SEA.

To the many marvelous achievements which have been placed to the credit of American railroad builders must now be added one other, the accomplishment of the apparently paradoxical feat of building a railroad at sea. This road, which stands unique among ways of transportation on the face of the earth, has just been opened to traffic, and travelers over it are today enjoying the novel sensation of literally going to sea in a parlor car, from the windows of which they can look out upon the blue waters of the ocean beneath and around them as they rush along as confidently as if their way lay over the solid land instead of out of sight of it.

This remarkable railroad is the famous Key West extension which Mr. Henry M. Flagler has been adding to his Florida East Coast Railway, and it runs from Miami, on the southern coast of the State of Florida, along the long curving line of the Florida keys toward the island city of Key West, which is to be its ultimate terminus. The section opened to traffic, however, extends only to Knights Key, 47 miles this side of the ultimate destination, where a temporary terminal has been established, and from which daily steamers land the traveler in Havana, 115 miles distant, in a trifle over seven hours.

The completed section of the road is 109 miles in length of which the first 45 miles from Miami to the coast is on the mainland of Florida. It is through the strange region of the Everglades, however, where the land is barely above the sea level and is practically one vast swamp. After struggling through this region to the water's edge the road becomes truly marine, or, more exactly, amphibious, and for the remaining 64 miles to Knights Key it goes by sea and land indifferently, following the lowlying coral keys where they are in its path and crossing the intervening stretches of sea on embankments built up from the ocean bed itself or on viaducts supported on piles, which in turn are anchored to the coral bottom. On these embankments and viaducts the road is carried for more than half the distance. Some of the ocean passages which they span are only a few hundred feet wide, some are thousands of feet, and the longest of all, between Long and Grassy key, which was the last portion of the work to be completed, is 5.6 miles from end to end, of which the central reach of more than two miles is crossed by the great ocean via-

duct. It is in making this crossing that the trains go out of sight of land.

The aggregate length of the construction over water between Water's Edge, where the road leaves the mainland, and the temporary terminal at Knights Key, is 72,884 feet, or in round numbers, 14 miles. The first water opening of any length crossed by the traveler is over Snake Creek in Plantation Key, which is 725 feet across. Then from Windlys Island to Upper Matecumbe Key comes a fill of 2,450 feet.

The next gap, from Upper Matecumbe to Lower Matecumbe is crossed by an embankment 11,950 feet from end to end, with a 120-foot drawbridge to allow the passage of vessels. A still wider passage intervenes between Lower Matecumbe and Long Key, which are joined by an embankment of 21,800 feet. Then comes the stretch of open water between Long and Grassy Keys, 5.6 miles across, which the road spans by the great ocean viaduct, 10,444 feet in length, with embankments at each end which together add 19,100 feet more. From Grassy Key over the Crawl Keys to Key Vacca are other embankments of 4,875 feet in aggregate length, one of which, 500 feet in length, crosses a channel 20 feet deep, and from Key Vacca to Knights Key is an 1,100-foot embankment. A trestle 2,000 feet long leads from Knights Key to the Knights Key dock, to which a deep channel leads, permitting vessels of 20 feet draft to come alongside the dock itself.

The 47 miles of unfinished work from Knights Key to Key West will add 78,550 feet more of embankment and viaduct, making the total for the entire extension 155,000 feet, or 29.4 miles. To this can be added the 17 miles from Homestead to Water's Edge, through the Everglades, which is practically a continuous embankment, dredges having been used in the construction work for the entire distance.

The most important openings in the uncompleted portion are between Knights Key and Pigeon Key, where there is an opening of 10,250 feet, of which 7,300 feet is to be crossed on a viaduct; between Pigeon and Little Duck Keys, where there is a 22,900-foot gap of which 7,800 is to be viaduct, and from Bahia Honda Key to West Cumberland Key, 5,600 feet, of which 4,950 feet is to be viaduct, with a 250-foot draw for vessels.

On the building of this road all the resources of the great inter-

ests controlled by Mr. Flagler have been concentrated for three years. The task has been a most difficult and costly one, to the ordinary obstacles which confront the railroad builder being here added the extraordinary ones arising from the unique nature of the task. Not the least of these has been the necessity for bringing all the material, and even drinking water for the workmen, in boats from the mainland, more than a hundred miles away, for the keys are mostly barren. They contributed to the building only the coral rock for the miles of fills. Even floating dormitories for the men had to be provided over portions of the route.

It is estimated that the building of the road is costing more than \$100,000 per mile and that in all it will cost nearly \$20,000,000. Another remarkable feature of the project is that the burden of financing this tremendous task and providing these needed millions is being borne by Mr. Flagler alone and unaided. No contractors, even, have been employed, the work of construction being under the personal direction of Vice-President, J. R. Parrott.

It has naturally been necessary to construct the ocean-going portions of the road with the greatest solidity to make it safe against the assault of wave and storm. The rails are carried at a uniform elevation of 31 feet above high tide level, which puts them safely above the reach of the highest seas ever seen in these regions of the keys where the ocean, as the fact that it is possible to build the road at all makes evident, is nowhere of great depth. In fact, as he rides over this unique road the traveler can glimpse now and then beacons in the long line of lighthouses which stretches on the Atlantic side of the keys from Miami to Key West to keep vessels from their perilous shoals.

It is anticipated that another year will be required for the completion of the remaining portion of the extension to Key West, when that outpost port of the United States will be placed in direct rail connection with the continent and the passage to Havana will be still further shortened to 90 miles.

Already the time between New York and the Cuban capital is reduced by half a day by the new route, a fact which has its readily apparent political and economic bearings.

The Iola Portland Cement Co. paid about \$15,000 in taxes on its plant at Iola, Kansas.

The Raven Lake Portland Cement Works, at Raven Lake, on the Grand Trunk Railway, Nipissing Branch, northwest of Lindsay, are being offered for sale by public auction at the Auction Rooms of C. J. Townsend & Co., 68 King St., East, Toronto, Ontario, Canada on the 25th day of January, 1908. It is a four kiln wet process plant, marl and clay, which may be converted into a dry process by the addition of a further crushing capacity. There are four rotary kilns, fed by four plunger pumps. The pulverized coal is carried to kilns by compressed air feeders, regulated by variable speeders. There is a complete coal-grinding apparatus. The clinker-grinding machinery is modern. There is a rotary clinker cooler, and all necessary elevators. The dredging outfit is fitted with the Harris system for pumping marl from the dredge to the factory by compressed air, also stone separator.

All the machinery, except the dredge, is driven by electrical power developed from the Company's own water privileges. The water installation consists of two Jenokes turbines, connected with two C. G. E. generators, 375 Kilowatts each, and one 25 Kilowatt D. C. generator, connected to a small water wheel. Power is transmitted by proper pole and wire line. There are all necessary transformers and switch-boards. In all there are 28 C. G. E. motors, ranging from 10 to 75 horse power, and one westinghouse motor of 100 horse power.

There is a splendid deposit of marl, and a good supply of lime stone. There is also a large quantity of clay, all situated on the Company's property. The buildings are large, and principally of stone and concrete construction, the stock house being 188 long by 80' wide, the kiln building 90' by 68', the fuel building 70' by 24'. The whole property is being offered for sale subject to the reserved bid.

For further information and conditions of sale, apply to Messrs. Hewson & Creswicke, Barristers Barrie or to the Trusts and Guarantee Company, Limited, Liquidators, 14 King St. West, Toronto.

PRIZE CONTEST.

A very careful canvass of the field by the Miracles and their representatives during the past year has shown to them a very highly satisfactory improvement in the quality of concrete products generally being turned out, and has satisfied them that there is a strong ten-

dency towards more studious methods and an eager anxiety for improvement in appearance, texture, and the general quality of cement products.

Following their enormous campaign of general publicity advertising, and realizing this forward tendency, and desiring further to stimulate it to the greatest possible degree, the Miracle Pressed Stone Co. has decided to offer to manufacturers of concrete products, using their various machines, molds, and equipment, a total of \$600.00 in cash prizes, for the best specimens of products submitted at the next Chicago Cement Show, which will occur the latter part of 1908.

This we predict will result in a very lively competition for a great many reasons, the principle one of which is the educational value of such a contest to the trade in general, in that it will stimulate them throughout the year to exert every effort to obtain a higher class product than they have heretofore made.

If you are manufacturing concrete products, it will certainly be worth your while to take home one or more of these blue ribbons.

The prizes will be divided as follows:

\$200.00 for the best specimens of concrete block, which will be subdivided as follows: First, \$100; Second, \$40.00; Third, \$30.00; Fourth, \$20.00; Fifth, \$10.00.

On Tile, Sewer Pipe and Brick, \$200.00, to be divided as follows: First, \$100; Second, \$40.00; Third, \$30.00; Fourth, \$20.00; Fifth, \$10.00.

On Ornamental Stone, \$200.00 to be divided as follows: First, \$100; Second, \$40.00; Third, \$30.00; Fourth, \$20.00; Fifth, \$10.00.

Those desiring to enter this contest should notify the Miracle Pressed Stone Co. at once, and they will receive in return a complete circular of information concerning the conditions of the awards. This information will give the points of merit upon which the prizes will be awarded, manner of selecting judges, and in fact complete instructions concerning the whole proposition.

The Australian Government has built a woven wire rabbit proof fence 2036 miles long, at the cost of \$1,250,000; the object being to prevent the rabbits from passing to the west of the fence. Traps are built in the fence at intervals of 5 miles where hundreds of rabbits are captured and destroyed daily. The

East end of the Fence is infested with millions of rabbits while the west end is almost free from the pest which destroys all vegetation, where repressive measures are not employed to subdue them.

Mr. F. K. Rhines, engineer, has become assistant to the treasurer and general manager of the General Fireproofing Company of Youngstown, Ohio.

Mr. Rhines came to the General Fireproofing Company from the Dixon Engineering & Construction Company of Toledo, Ohio.

The firm of C. Dengg & Co., Vienna, Austria advertise a hydraulic cement ware press capable of exerting a pressure of 143,000 tons on a single cement form. This is equal to a pressure of 286,000,000 lbs. These presses have been in the market and in use for over five years.

Messrs. Myron H. Lewis and Clifford B. Moore, Editors of "Waterproofing" wish to announce to the Profession and to the Building Public that they have opened offices in the St. James Building, 1133 Broadway, where they will conduct a general Consulting Engineering Business in Waterproofing, Foundations, Hydraulics and Reinforced Concrete. Special attention will be given to making investigations, reports and tests and to the preparation of plans, estimates and specifications for Waterproofing and Dampproofing work of every description.

Samples of all commercial Waterproofing and Dampproofing products and Literature and full information concerning every modern process will be kept on hand for the convenience of Architects, Engineers and Builders, making this office an "Exchange" or "Information Bureau" for the Waterproofing Business.

Export of Domestic Cement for the year ending June 30, 1907, valued in American money was as follows. To Europe \$496; North America, \$1,063,424; South America, \$114,586; Asia, \$200; Oceanica, \$858; Africa, \$851. Total value \$1,180,415 on imports of cement during the same period has valued at \$3,778,114, the value of our imports in this material over our export being \$2,597,699, our own home demand has been so great that the mills could securely meet the demand therefore our export trade has been neglected.

HENRY M. FLAGLER.

Henry M. Flagler is one of the pioneer advocates of concrete construction in this country. In the early eighties when cement construction was under the ban of popular prejudice, he began the erection of three of the most magnificent winter resort hotels in the world, using shell concrete throughout. These hotels are located at St. Augustine, Fla., and are known as Hotel Ponce de Leon, opposite to which is the Hotel Alcazar and Hotel Cordova. These structures opened the eyes of architects and builders as to the utility of concrete as a building material. Millions of dollars have been spent towards making Florida an ideal winter resort by one man, Mr. H. M. Flagler, and now he is bridging the sea with concrete. The question is often asked whence comes all this vast wealth which passes through Mr. Flagler's hands, in the under-

being furnished by Mr. Flagler. The \$80,000 invested in the Standard Oil Co. by Mr. Flagler brought him in scrip dividends, up to 1887, \$1500 for each dollar invested; which scrip dividend was converted into stock of the company realizing one hundred and twenty million dollars on the original investment, besides the regular cash dividends of from 10 to 40 per cent. per annum. This is the basis of Henry M. Flagler's financial strength in Florida. Mr. Flagler is the central figure in the portrait group shown.

Wm. Seafert.

The Virginia Portland Cement Co. will double the capacity of its plant at Craigsville, Va., the funds being secured from the New York Trust Co. on a \$2,000,000 trust deed which has been filed with the clerk of the Circuit Court at Staunton, Augusta Co., Va.

BRITISH-AMERICAN PORTLAND CEMENT COMPANY.

The British-American Portland Cement Company of Nowata, Okla., is planning to build a plant with daily capacity of 3,000 barrels of Portland cement. This company was incorporated recently with a capital stock of \$3,750,000 and has secured extensive tracts of land near Nowata containing large deposits of the necessary limestone and shale. Its general offices are with F. C. Vincent & Co., 900 Scarritt Building, Kansas City, Mo., and its officers are as follows: President, William Peet, of Kansas City; vice-presidents, John S. Logan, of St. Louis; F. G. Thrall, of Eureka, Kan., and J. E. Campbell, of Nowata; treasurer, J. H. Harrington; secretary, W. D. Vickers, and general manager, Frederic C. Vincent, each of these three of Kansas City.

U. S. PORTLAND CEMENT CO.

Florence, Jan. 15.—At the annual meeting of the United States Portland Cement Company, held in this city yesterday, the following directors were named for the ensuing year: J. D. Blunt, G. D. Cummings, Lee Champion, A. K. St. Clair and W. H. Kelso. This board then named the following officers: J. D. Blunt, president and manager; G. D. Cummings, vice-president; W. H. Kelso, secretary and Lee Champion, treasurer. The majority of stock was represented and a number of out of town stockholders were present.

After the conclusion of the meeting the stockholders went to Concrete to inspect the work so far accomplished and were well satisfied. They ate dinner at the company boarding house.



Group Showing Henry M. Flagler in Center.

taking of these gigantic operations on the East Coast of Florida. In 1867, Mr. Flagler succeeded Mr. John D. Rockefeller in the produce commission business in Cleveland, O. Mr. Rockefeller going into the oil business on a capital of about \$5000. While in the commission business, Mr. Flagler made a lucky turn in Chicago wheat, cleaning up about \$80,000; such was the current report prevailing in Cleveland at this time. This eighty thousand was then invested in John D. Rockefeller's oil enterprise, and he was succeeded by Frank Rockefeller, and one Davis in the commission business. The writer in 1870 took the first statistical report of the Standard Oil Company business, for the Government, the same

IMPORTS OF CEMENT INTO THE UNITED STATES.

WHERE FROM	NOVEMBER				ELEVEN MONTHS ENDING NOVEMBER			
	1906		1907		1906		1907	
	Quantity in lbs.	Value in Dollars.	Quantity in lbs.	Value in Dollars.	Quantity in lbs.	Value in Dollars.	Quantity in lbs.	Value in Dollars.
United Kingdom	5,884,208	\$18,185	11,848,400	\$42,339	160,262,664	\$468,880	210,127,421	\$ 742,565
Belgium	30,102,268	104,176	9,376,808	27,605	224,172,491	729,046	210,601,537	627,715
France	5,155,418	19,556	3,323,567	9,023	14,127,900	50,180	13,354,096	50,392
Germany	33,512,636	98,822	35,405,342	115,551	278,737,457	890,588	297,486,484	953,953
All Other Europe	19,063,600	55,320	595,100	1,344	19,361,853	56,240	3,245,613	10,093
British North Am.	504,760	3,624	1,890	15	3,835,833	27,077	336,640	2,076
Other Countries	6,500,800	33,245	1,614,920	8,132	72,976,104	335,740	8,298,972	43,763
TOTAL	106,723,690	332,928	60,966,027	204,009	773,294,302	2,557,751	743,450,763	2,430,557
Domestic Exports of Cement, bbls.	69,113	122,803	65,357	100,605	549,631	891,083	850,871	1,373,024

There were 10,733,241 lbs. of imported Roman and Portland Cement, etc., in the United States bonded warehouses in Nov., 1906, valued at \$34,355, against 16,870,806 lbs. in Nov., 1907, valued at \$49,573.

For eleven months ending in Nov., 1906, there were 94,675 tons of asphalten imported in the United States, valued at \$373,486, against 117,073 tons imported in eleven months ending Nov., 1907, valued at \$475,200.



REINFORCED CONCRETE.

Any consideration that can be given the subject of Reinforced Concrete must necessarily be predicated on the application or use of some special method of reinforcement. Comparison can only be made of the advantages by the results that appear from its use, i. e., any calculation that may be made for the construction of a reinforced concrete beam, column, slab or other form of section must essentially be limited to some particular form of application and the kind of reinforcement used and the rules deduced therefrom can, of course, have no general application to the use of reinforced concrete, except so far as that particular system may conform to the required conditions.

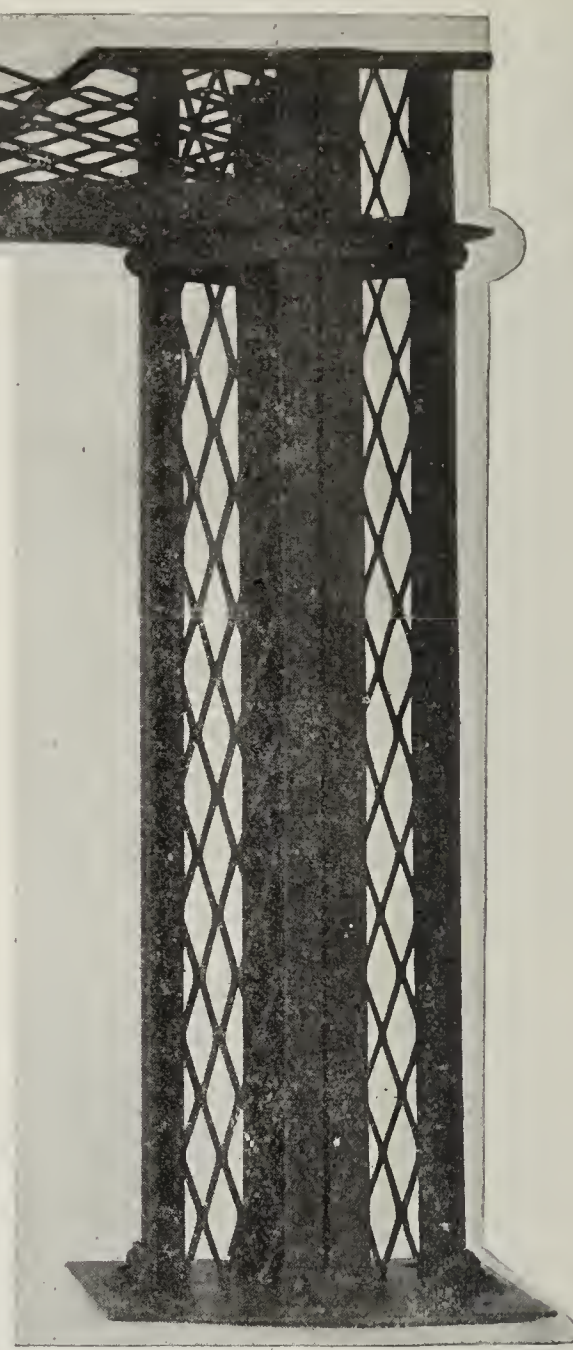
If the steel used in concrete is to be effective and its value fully realized, it must be placed with mathematical precision and must be retained in such position until the concrete is cast around it. No ordinary skill is required to accomplish this. A thorough knowledge of mechanics is necessary to determine its proper and effective location, which must also be coupled with care and diligence in its placement

and retention. The location of the steel must be such as to conform to the principles of mechanics, so that the concrete work will be properly strengthened in its weakest parts, and every part must receive its due consideration in determining its proper location and quantity.

No additional amount of steel will atone for an improper placement or any displacement in the section and will not increase the value of the concrete beyond its own resisting power. The reinforcing sections must be such as to aid, strengthen and provide the required resisting forces of tension and shear in the form of their action in the structure to the extent and value of the concrete used; for, as the stability of the structure depends primarily on this feature, it is of the greatest importance that the reinforcement be of such a character that when installed in the building it will not only be capable of performing its function of absolute security but will be in the right place and so connected throughout the whole system that it cannot be displaced when casting the concrete around it.

These conditions have created a demand for simple and practical methods of reinforcement and a system that could be easily and effectively applied by any and all who may be engaged in such work without the risk involved in the usual and more complicated methods.

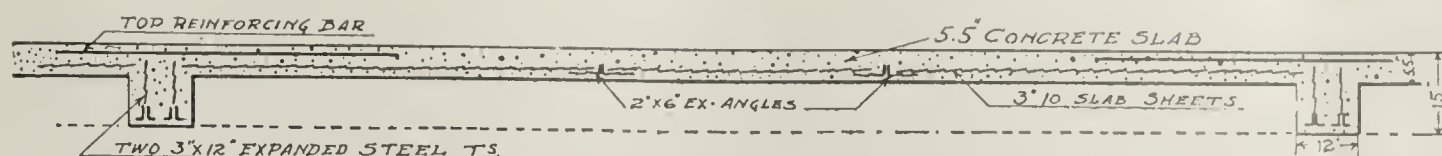
The Expanded Steel System is designed to meet this demand and in it will be found all the advantages of every known method as well as many not obtainable in any other system of reinforced concrete. Its simplicity and adaptability to any and all conditions, such as the construction of beams, girders, floors, roofs, curtain walls, retaining walls, bridges, dams, flumes, waterways, reservoirs, tunnels, piers, abutments, chimneys, and in fact every form of concrete work, is most commendable in its simple and effective provision. It is a shop built system, structural in form, and leaves the factory ready for placement in the structure in unit sections, so that no mistake can be made in its use. The columns are completely assembled so as to provide for all the stresses which in-



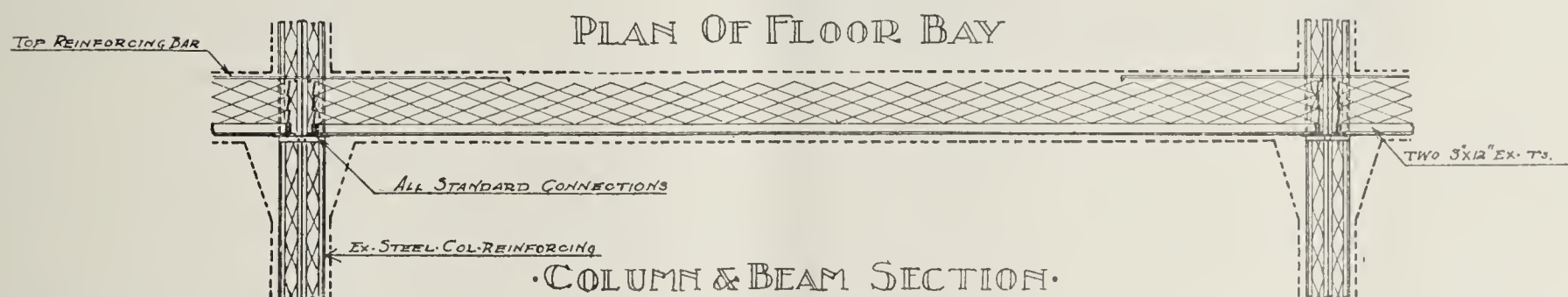
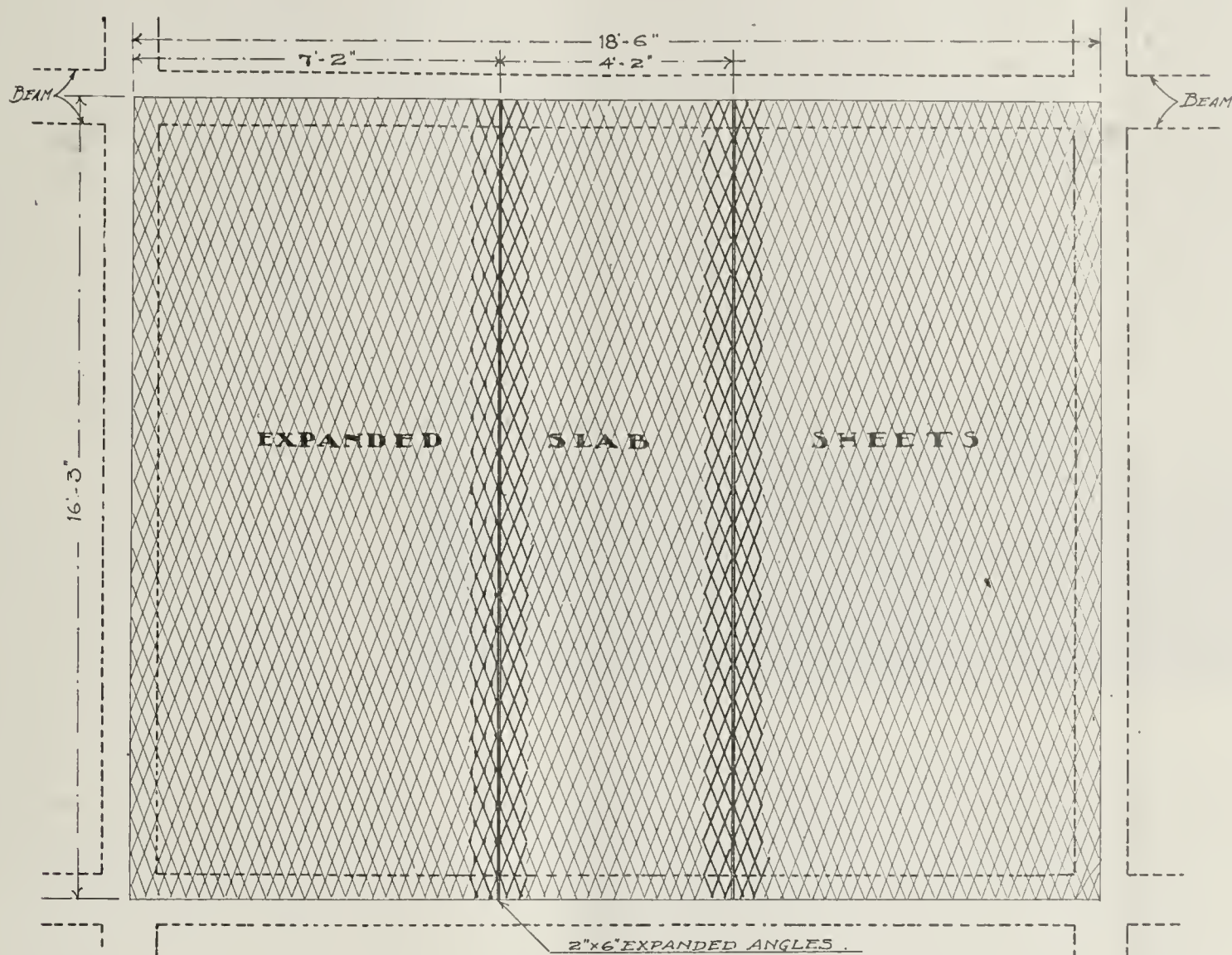
volve the use of steel in such a section, making it only necessary to set them up in place the same as any structural column. When in place they are ready for the concrete cast which may be in any desired form, such as square, octagonal or round.

The beam reinforcing section is also a built up form complete in itself, providing fully for every requirement necessary in a safe, simple construction and of such a character that any one may use it with the most satisfactory results. Its form and shape suggest the cast to be made as well as its proper placement so that no special instructions are necessary in the practical and effective use of the Expanded Steel Tee beam.

The construction of slabs, whether for floors, roofs, walls or other purposes, is rendered most simple and easy by the use of the Expanded Metal slab sheet and stress bars, which are also manufactured sections and ready for placement. Like all other sections in the Expanded Steel System of Reinforced Concrete, their form and shape suggest their proper placement and the necessary cast to be made. Spans of almost any desired length may be



SECTION THRO BEAM & FLOOR SLAB
- 1/2" SCALE.



constructed with perfect safety and to carry any required load.

The simplicity and efficiency of the Expanded Steel System of Re-

inforced Concrete coupled with its adaptation to every form of concrete construction is its crowning merit. Whether in the hands of the novice

or the expert it yields the important advantages of safety, economy and certainty.

Northwestern Expanded Metal Co.

The bid of Backus, Giebisch & Joplin of \$77,000 for a reinforced concrete bridge to span Sullivan's Gulch in the city of Portland, Oregon, was the lowest bid received by the city authorities by \$17,000. On account of the indefinite specifications for the work the matter is to be considered at a special meeting of the board in the near future, when it is expected to award the contract to the lowest bidder, provided the city engineer approves the completed specifications.

The Northwestern States Portland Cement Co. Works at Mason City, Iowa, commenced crushing rock on January 11th. The plant is to be started up before the middle of February.

The City of Dallas, Texas, has contracted with the Iola Portland Cement Co. of Texas for 25,000 barrels of cement at \$2.00 per barrel f.o.b. at the plant. Deliveries are to be made as required up to December 31, 1908.

CEMENT IN VENEZUELA.

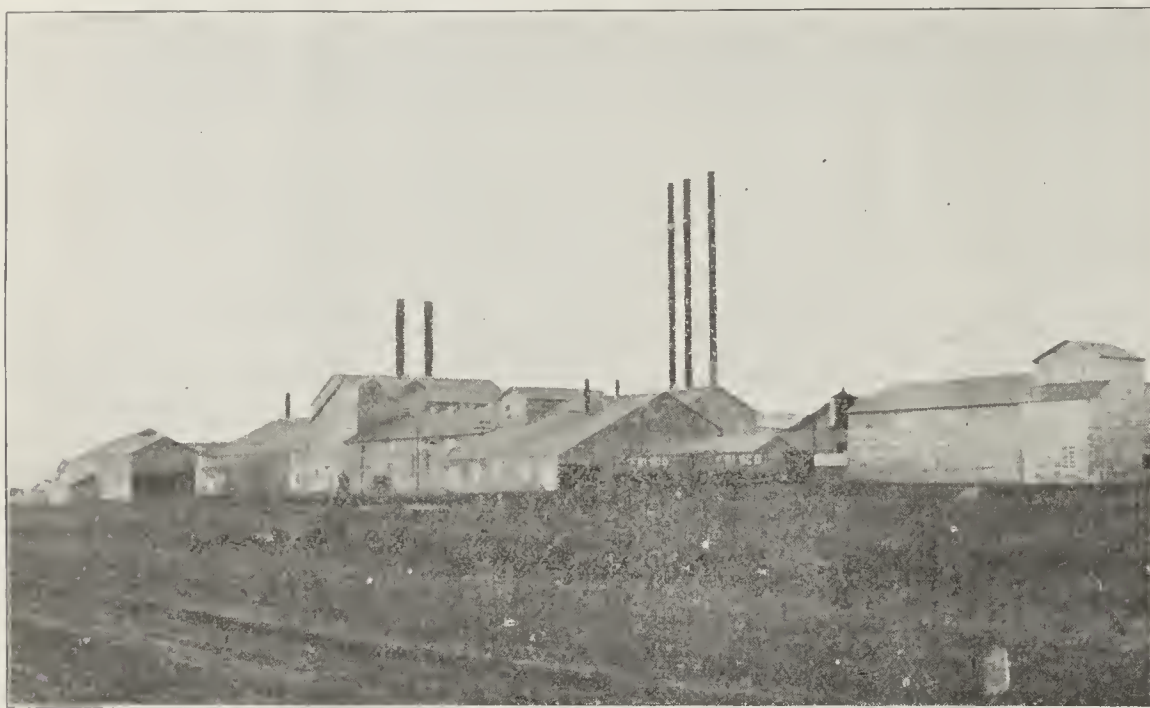
To Alberto Smith, a Venezuelan, is granted the right to establish plants for the manufacture of Roman cement. The concessionaire binds himself to furnish the government with cement for the price of 16 bolivars (\$3.20) per barrel of 180 kilos—6 bolivars less than the current price—and to sell to private individuals for 20 bolivars per barrel. The retail price of the cement per barrel for private parties is at present about \$4.60.

THE OKLAHOMA PORTLAND CEMENT PLANT.

The Oklahoma Portland Cement Company, located at Ada, Okla., is now shipping cement, having finished their construction work some days ago. It is one of the most modern and best equipped plants in this country, embodying all the latest improvements in cement mill

made up by the superior fuel efficiency of natural gas, weight for weight, as well as the greater economy of labors and the cost of removing ashes, where coal is used. The number of natural gas companies fell from 2139 in 1905 to 1871 in 1906, the increase in distance to which gas is piped tends to the consolidation of the smaller com-

York, with an output of 2,547,769, valued at \$672,795, or at the rate of 26.4 per 1,000 cubic feet, while the consumption was 10,182,422 cubic feet, valued at \$2,654,115. Natural gas in Kentucky sells for 36.4 cents per 1,000 feet, and in California at 87.9 cents per 1,000. In Colorado 96.7 cents per 1,000 feet, the average price of the entire output being 12.1 cents per 1,000 feet. The combined value of natural gas and crude petroleum increased from \$125,720,254 in 1905 to \$139,318,667 in 1906—a gain of over \$13,500,000—and was the greatest value ever recorded. Every producing state joined in the gain except Indiana and Colorado. Pennsylvania was still in the lead, followed by West Virginia, while California, first in quantity of oil produced, was sixth in total value.



machinery. The equipment in this plant includes a No. 6 McCully crusher, 3 Ruggles-Coles Dryers, 2 125x7 ft. kilns, 12 Lehigh Car, Wheel & Axel Works Fuller mills, 3 Bates Corliss engines, 3 Babcock & Wilcox water tube boilers, and etc.

Exhaustive tests of the finished product show their cement to be of the highest possible grade and their "OK" brand, named in honor of the new State of Oklahoma, will rank with the best.

The Company has booked orders for over 30 days run of the mill in addition to a goodly number of contracts running through the season.

The officers of the company are as follows. A. L. Beck, Pres., C. C. Bishop, Vice Pres., J. M. Winter-shutt, Sec't. and Treas., W. M. Whitaker, Manager.

THE NATURAL GAS OUTPUT FOR 1906.

Statistics collected by the U. S. Geological survey show that 388,842,562,000 cubic feet of natural gas was produced in this country in 1906. Measured at atmospheric pressure. This volume of gas is computed to have weighed 9,396,963.8 short tons, valued at \$46,873,932, or 12.8 per cent over the production of 1905. The average value of natural gas was \$5.00 per short ton, while the average price of Bituminous coal was only \$1.11 per ton. The difference in value is fully

panies faster than new one are formed.

For years Pennsylvania, West Virginia, Ohio, and, more recently, Kansas, Oklahoma, and Indian Territory have produced more gas than they have consumed. In 1906 Pennsylvania reversed the conditions, and consumed slightly more than her entire product, borrowing from West Virginia to make up the deficiency. New York and Ohio also drew heavily on other States for their supply. This increased pumping of natural gas has tended greatly to the steadying of the industry and to the development of enterprises dependent upon it. The transportation of the gas is so much cheaper than that of coal that the gas competes with coal at comparatively greater distances.

Pennsylvania produced 138,161,385 cubic feet of gas in 1906 valued at \$18,558,245, being at the rate of 13.4 per 1000 cubic feet and consumed 162,095,173 valued at \$21,085,077. Ohio produced 45,436,020 cubic feet in 1906, valued at \$7,145,809 and consumed 74,812,562, valued at \$12,652,520, being at the rate of 16.9 cents per 1,000 cubic feet. West Virginia produced 119,400,392, valued at \$13,735,343, or 11.5 cents per 1,000 cubic feet, and consumed 58,455,009, valued at \$3,720,440, or 6.3 cents per 1,000 cubic feet. Kansas produced 69,322,633 cubic feet in 1906, valued at \$4,010,986, or 5.8 per 1,000 cubic feet. New

SHRINKAGE OF WOOD WHEN DRIED.

Forest Service, Washington, D. C.,
Trade Bulletin No. 17.

Interesting experiments on the shrinkage of wood due to the loss of moisture have recently been completed by the Forest Service at its timber testing station at Yale University. These experiments show that green wood does not shrink at all in drying until the amount of moisture in it has been reduced to about one-third of the dry weight of the wood. From this point on to the absolutely dry condition, the shrinkage in the area of cross-section of the wood is directly proportional to the amount of moisture removed.

The shrinkage of wood in a direction parallel to the grain is very small, so small in comparison with the shrinkage at right angles to the grain that in computing the total shrinkage in volume, the longitudinal may be neglected entirely.

The volumetric shrinkage varies with different woods, being about 26 per cent of the dry volume for the species of eucalyptus known as blue gum, and only about 7 per cent for red cedar. For hickory, the shrinkage is about 20 per cent of the dry volume, and for long-leaf pine about 15 per cent.

In the usual air dry condition, from 12 to 15 per cent of moisture still remain in the wood, so that the shrinkage from the green condition to the air dry condition is only a trifle over half of that from the green to the absolutely dry state.

The Kansas Portland Cement Co. which shut down on December 24, expects to resume with a full force, at once.

U. S. REINFORCED CONCRETE PRISONS.

The New Additions to Federal Prison at McNeill Island, Washington, Will be Constructed in Reinforced Concrete.

The new buildings the government is putting up at the penitentiary are three in number, consisting of a cell wing, a dining hall, and officers' quarters.

They are fireproof structures, with the outside and interior walls, including the floors, constructed of reinforced concrete. The cell wing is 95 x 42 feet, three stories high, containing forty-two cells, and dressing, bath and guard rooms and guards' corridors. The dining hall is 50 x 42 feet and will seat 200 prisoners at its tables. At the north end is a modern kitchen, pantry and store room, occupying a space 42 x 24 feet.

The walls and floors of the cells are of concrete six inches thick, reinforced throughout with seven-eighth-inch steel bars. Each cell contains a toilet, washbowl and cot. The cell doors are operated by levers from the guards' corridors. The steel bars placed in the walls of the cells are so close together that the architects claim it will be impossible for any prisoner to bore through. When completed the improvements will represent a cost of \$90,000. The cell wing will accommodate about 100 prisoners.

The new additions to the U. S. prison at Leavenworth, Kansas, will be constructed of the same materials.

SUCCESS OF THE PARKER LIGHT DERRICK.

The Parker Hoist & Machine Company, 971 North Francisco avenue, Chicago, are manufacturing what is considered by many to be the handiest, most convenient, economical and up-to-date derrick upon the market, and to this thousands of contractors, bridge builders, railway, mine and other large companies who have light lifting to do, are ready to testify. The little derricks shown on this page are what they call the Parker patented derrick No. 1, the capacity of which is 1,500 pounds. They also make the same machine in a larger size called Parker patented derrick No. 4, capacity 4,000 pounds. The booms, or reach, vary from 12 to 30 feet. They can also be used to great advantage when mounted upon a small car or truck, which is sometimes furnished.

These derricks are the outgrowth of years of earnest effort by engineers in this line. Under the most trying conditions these little derricks have emerged triumphant. In the evolution and perfection of these derricks contractors and other users have played no small part. Its manufacturers attribute much of the success these derricks have achieved to practical suggestions received from them. They endeavored to adapt and develop their practical ideas, to improve parts found wanting and make changes where they thought they were necessary or advantageous. The result is the modern and up-to-date Parker derrick. Since the introduction of this machine in 1901 it has been improved and perfected. The derrick is now a model of simplicity, consisting of very few parts, namely:

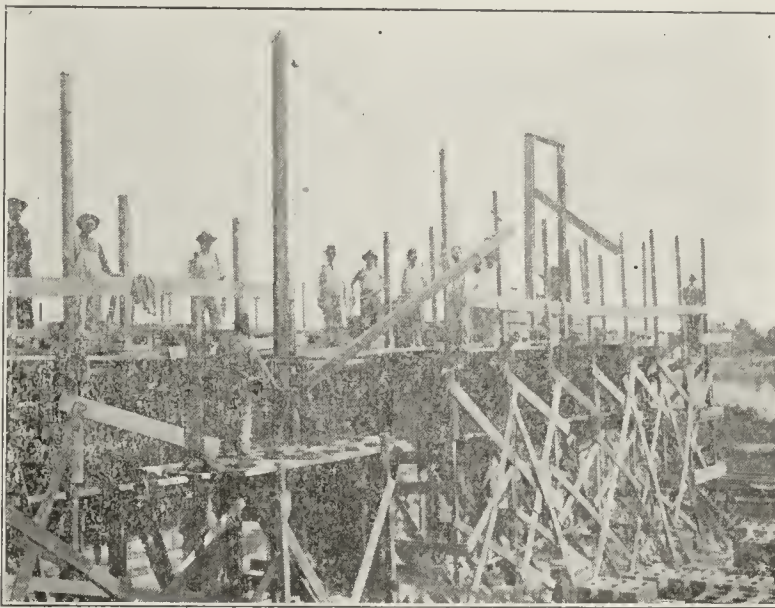
1. Cross base with center post braced by four steel braces and provided with a cast thimble which the frame of the machine rests on.
2. The frame with gears, drum and brake. This part is slipped upon the center post of the base.
3. Mast with necessary guys.
4. Boom with necessary cables and blocks.
5. Small winch strapped to mast for operating the boom is only needed where lifting of 1000 pounds and up is required.

Every part entering into the construction of these derricks is made of the very best materials obtainable. All shafts are steel. Bearings are babbitted with genuine babbitt. The machines are guyed with four guy lines and turn a full circle. There are thousands of them in use throughout the country, all giving perfect satisfaction.

The company also manufactures a complete line of high grade hoist-

ing engines, derricks, cranes and hoists and are at present engaged in the building of several large derricks electrically driven for the Chicago City Railway Company, Chicago, also a large electric hoist for the Cummings Foundry Company of Chicago, together with an immense number of miscellaneous orders such as engines, cranes and derricks.

The manufacturers have a very neat catalogue describing their line in full, together with numerous photographs and testimonials of their products, which will be sent upon application. The manufacturers have an efficient staff of engineers and are in shape to design or manufacture anything in the hoisting line and will be pleased to communicate with any one who may have work of the character in contemplation.



CONCRETE WALKS IN SUPERIOR, WIS.

The concrete walks laid in the city of Superior, Wis., since 1903 would cover an area of $21\frac{1}{2}$ acres or 150,106 lineal feet in length nearly $28\frac{1}{2}$ miles laid end to end, 21,274 miles being built under city contracts and cost \$116,538 or \$1.04 per lineal foot. While 7,154 miles were built under private contract. The walks vary from 4 to 20 feet in width, the average being $6\frac{1}{4}$ feet. The total cost of all cement walks laid in the city is about \$160,000. The walks laid in 1907 cost \$73,000.

The Monarch Portland Cement Companies will remove its general offices from Wichita, Kans., to Humboldt, Kans., to be near the works which is located at Humboldt.

The Kansas Portland Cement Co. paid \$6,000 taxes for 1907 on its plant at Iola, Kans.

ELECTRICITY FOR CEMENT PLANTS.

The applications of cement have been so enormously increased in the last two years as to almost justify the name for the present period as The Cement Age. This increased demand and the high prices which have been maintained, has created a large number of new Companies, and has stimulated the remodeling of old plants to increase their output.

It is predicted that the total output of cement for 1907 will equal, if not exceed, 60,000,000 barrels; yet this supply, it is claimed, will fall far short of the demands.

The object of this paper is to point out some of the special advantages of the electric drive in the manufacture of cement both in economy and flexibility. From the economical standpoint the savings of one cent per barrel on a thousand barrel plant would justify a first cost of over \$50,000.00 economy in the manufacture of cement is so closely connected with flexibility that it seems almost one and the same thing. Economy to cement manufacturers seems continuous operation, and continuous operation is contingent on flexibility.

There are few if any plants which are not making good profits under the present condition of prices; yet there are any number of plants which are producing cement at a high cost of manufacture because of the inefficient layout of their plants and the uneconomical transmission of their power.

Electricity versus Mechanical Drive.

The cement industry has been very conservative in the adoption of electricity for the transmission of power; yet in every other line of manufacture, mechanical transmission has been superseded by electricity even at great expense; and the results have proved that the electric drive has either increased the output, simplified the process of manufacture, improved the economy, or made easy the superintendency of the plant. Many Western cement plants are already driven throughout by electricity, and yet in the East, the cement manufacturers use the electric drive only where the mechanical drive is prohibitory.

The cement industry opens a large field for the application of electricity. The simplicity in the manufacturing of cement permits

of a division of the different departments in such a manner that each department can be regarded as a unit, having its local manager who is held responsible for its satisfactory operation.

With the electric installation, a ready record can be kept of the power consumed in each department, and the Superintendent can easily locate the department responsible for any decrease in output for each day. A record of the power consumed in each department shows at a glance, whether the consumption is above or below normal, and any deviation should require a satisfactory explanation or should indicate that the machines are not operating satisfactorily.

Electrical Flexibility.

The profits in the cement industry demand the continuous operation of each machine at its full load; to obtain this, it is necessary to have flexibility in the power applied, and electricity permits of greater flexibility than any other mode of operation.

The installation in the power house of two or three generators insures a constant source of power for each and all departments. The switchboard, if properly subdivided and arranged with one feeder panel for each department, each panel equipped with indicating ammeter or recording wattmeter, furnishes a constant indication of the power consumed by each department, and a record of these readings gives a ready reference to the operation of each department. Each department may be operated by one or more motors; if more than one motor is used, the group drive should be made as flexible as possible so that part of the load, if necessary, can be thrown from one motor to the other, or the groups entirely separate from the others so that part of the department will always be in operation.

Kilns.

The output of a plant is based on the output of each kiln and the number of kilns installed; this department is the very heart of the industry and the successful manufacturer should provide every means known to man to keep his kilns running and crowd them to the limit of complete calcination.

To accomplish this there are three different methods of control:

Variation of the speed of the kiln.

Variation of the feed raw mater-

Variation of the coal feed for combustion.

All these variations should be under the hand of the operator at the point where he can watch the calcination and change any or all of these to accomplish the most satisfactory results; here the application of the electric motor should play an important part.

Crushers.

Where it is necessary to use a number of Crushers arranged in groups, the most flexible arrangement would be to select a motor of about 150 to 200 h. p. and drive from a line shaft, each pulley on shaft equipped with a friction clutch. If the number of Crushers require more than one motor, put in another line shaft so arranged that it can be connected to the first line shaft by means of a friction clutch. Should it be necessary to add more groups, this can be easily accomplished by placing the Crushers either in parallel or series, whichever arrangement will enable the feeding and taking away of the material to be more concentrated.

Flexibility of the Buildings.

The power house, if properly designed, should permit of the shortest steam transmission from boilers to engines, and the building so constructed that should it become necessary to increase the number of units beyond the capacity of the building, the end of the building can be taken out and an extension made for both boiler and engine rooms without interfering with the continuous operation of the plant.

Electricity permits of the grouping of the buildings for each department in the most convenient sequence without being obliged to take into consideration the source of power, and also permits of the shortest transmission from one department to the next of the manufactured material. If possible, the building for each department should be constructed similar to the arrangement of the power house so that extensions may be added.

Selection of Motors.

Up to the present date it has been almost impossible to obtain satisfactory tests even on motor driven machines in cement plants as the power required to start some of the machines is so great and changes so quickly that it is hard to take a reading; and the running power is so small in comparison that manufacturers have been compelled to use motors of large horse power

ratings in order to be on the safe side.

There is now on the market a curve drawing meter which automatically records the power consumed and it is to be hoped that these tests will put the consumer in a better position to specify motors which will be nearer the running horse power of the machine than they are at present.

For the best results, motors, both direct and alternating current should be run as near their most economical point as possible, which naturally is full load rating.

It is not always possible to take these points into consideration as the limiting feature is the starting torque which is generally from two to three times greater than the running torque for most cement machines, yet with these curves, we believe it will not be necessary to install a 150 H. P. motor to operate a continuous load of 65 H. P. as many of the plants are doing today.

Belt Drive.

The belt drive is generally considered the most satisfactory for transmitting power from the motors to the machine. It often happens that Crushers get clogged and it is practically impossible to furnish sufficient power to start them again without cleaning them out. The belt drive relieves the motor from the enormous shock consequent on the stoppage of the machine and the belt would probably slip before the circuit-breaker could act, giving a double protection and also giving a protection to the cement machines that it is impossible to obtain from a mechanical drive, as you have no flexible arrangement that would automatically shut down your machine, mechanically driven, when excessively overloaded.

The belt drive also relieves the motors from the consequent jar of heavy starting loads.

At one of the local cement plants where a Crusher was driven mechanically, a large size shaft was twisted off by the clogging of the Crusher with a sledge hammer head. It is almost improbable that such an accident could happen if this Crusher had been driven by a motor with an automatic circuit-breaker.

Alternating and Direct Current Equipments.

Until recently, it has been the practice to equip manufacturing plants with direct current, 220 volts, chiefly on account of the great advancement that has been

made in that line of apparatus and especially where variable speed motors were needed for certain machine tools where the requirements are such that the direct current motor is more advantageous.

The alternating current has many advantages especially in the equipment of cement mills. The motors that are exposed to the cement dust are so simple in their construction that they do not need protection except dust guards for the bearings. The spare parts are so few as to almost be left out of consideration. The wiring and automatic protecting devices are enclosed in such a manner as to eliminate any sparking and consequent fire risk and the motors are rugged and better suited to heavy overloads.

The alternating current permits the transmission of power at a higher voltage which will greatly reduce the cost of installation. It was estimated in one plant of several thousand horse power capacity that the use of 600 volts instead of 480 volts showed a saving of over \$8000.00 on the installation alone.

For ruggedness, simplicity and continuity of operation, the turbine driven generator has no equal. This point is well illustrated by the following quotation from a letter of one of your members operating a cement mill in the West:

"The 800 KW. turbine now in operation, is giving splendid satisfaction and there is no question in my mind but that this type of power equipment is far and away the best for cement mill practice. We have had absolutely no difficulty of any kind or description in starting or operating this machine, and from our experience so far, we are inclined to think that when once properly adjusted, the turbine will practically run without mechanical attention indefinitely."

This letter refers to an alternating current turbine driven generator and was written entirely unsolicited. It was a comment on the turbine while the letter was begging the manufacturer to improve their promise of shipment on a new turbine of larger capacity.

Mechanical Versus Electrical Drive.

With the mechanical drive properly subdivided, you are dependent on one engine for one or more departments.

Electricity gives you two or three prime movers from which to draw your power.

If one line shaft distributes the power in any one department, and

it generally furnishes power to more than one department, any accident to that shaft might tie up the whole production of your mill.

With electric distribution, where properly subdivided, it would practically be impossible to so cripple the plant.

A line shaft has to be installed not only of sufficient capacity for the total maximum load but with a big margin of safety, and this entire mechanical drive has to be run continuously whether you are operating one or all the cement machines.

With the electric installation, you draw power only for the machines in operation and the efficiency of your plant is practically maintained.

Even if your kilns were driven by a separate engine and an independent shaft, any tie-up of either of these means of power distribution would shut down and seriously cripple the day's production.

A delay of one hour on ten kilns would mean over \$150.00 wiped out of the profits for the day, and it is seldom, if ever, the repairs can be made in one single hour with the facilities at hand.

The Electric Drive in this department would save you many hours of anxiety.

Mechanical transmission cannot give you the flexibility or the output you can obtain from the electric drive.

Will the Electric Drive Pay?

Your engineers ask—how can the electric be as cheap or as economical as the mechanical drive? The dynamic power of the engine has to be converted to electric power with a generator and back again with a motor. That is perfectly true but the commercial operation of a plant is a practical operation.

With the mechanical drive, you start your plant; get everything running smoothly, throw on your load and spend a lot of money and time to make tests on your engines to get your efficiency and it makes a fine showing, but take the same plant after a year's run and find what an enormous increase is demanded to accomplish the same result. It has been necessary to patch up here and there and to do it in the shortest possible time, for, the plant must run, and instead of twenty or thirty per cent loss in the mechanical transmission, you will find this figure enormously increased, and you have practically no means of knowing this except from the coal pile or another series of tests.

The electric transmission depreciates with far less rapidity than the mechanical, and any change of patchwork in the plant effects only a small percentage of the gross output of your power station.

You always have before you the instruments showing the power consumed and any increase in the demand for power is shown immediately; this fact alone would justify the electric drive where it is so important to operate continuously and to anticipate and to avert any trouble.

Co-Operation.

It is practically impossible for an Electrical Engineer to make satisfactory recommendations of electrical apparatus in a cement plant or any other kind of manufacturing plant without being perfectly familiar with the conditions under which the electric motor is to operate.

This requires the hearty co-operation of the Superintendent of the plant with the Electrical Engineer.

Competition.

The keen competition of the present period demands the highest quality, together with the greatest output of material with the least possible cost.

To be in a position to stand this competition, it is necessary for all manufacturers to use every means possible to bring their plants up to the highest points of economy and efficiency. It requires a man of strong character to seize the proper opportunity (which is generally dull times) to make these changes in his plant; in anticipation of the increased demand which will result from an inactive period.

A card index should be made of all generators and motors installed, and a record of any repairs or tests should be kept on these cards, the dates always being specified.

The motors on the switchboard should be read at stated intervals during the day and night, and a regular record made and filed away for reference. These records will appeal to Engineers, Superintendents, Managers and Board of Directors; and such a file of record, if intelligently used, will put the cement industry on a scientific and economical basis heretofore unknown.

J. Benton Porter.
General Electric Co.

The annual meeting of the Castalia Portland Cement Co., was held at Pittsburg on January 6. All of

the old officers were re-elected as follows: George W. Hackett, president and general manager; John S. Craig, vice-president; Charles L. Johnson, secretary and sales manager; J. M. Porter, treasurer. The company had a successful year and has a capable list of officers.

EL ORO TUBE MILL LINING.

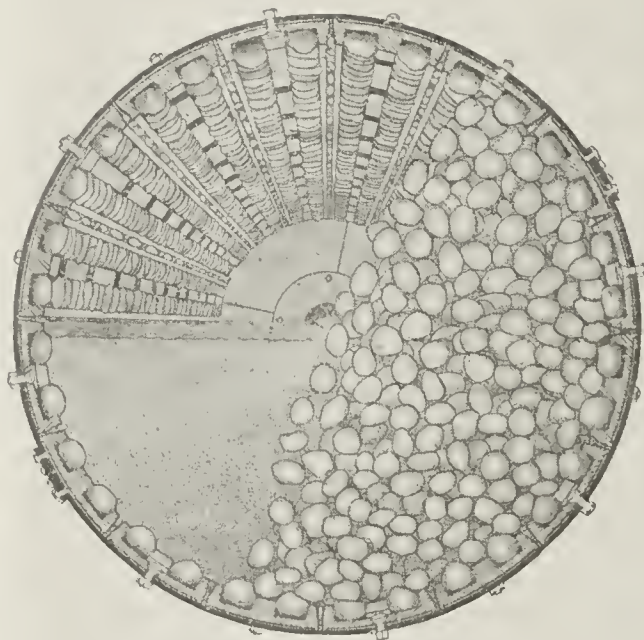
A new tube mill lining, the invention of Joseph Rodney Brown and consists of segments of white iron or steel as shown in the cut. These segments are bolted to the shell of the mill. On the face of each segment are longitudinal ribs forming channels wider at the inner face than at the base next to the shell. After the mill receives its initial charge of pebbles and is placed in operation, the pebbles are forced into the channels by the simple rotation of the mill this automatically forming a lining as shown in our illustration. When the pebbles become worn or fractured they drop out from time to time, and are again replaced automatically by other pebbles from the charge. Thus

ished their construction work some days ago. It is one of the most modern and best equipped plants in this country, embodying all the latest improvements in cement mill machinery. The installation includes a No. 6 McCully crusher, 3 Ruggles-Coles Dryers, 2 125x7 ft. kilns, 12 Lehigh Car, Wheel & Axel Works Fillers mills, 3 Bates Corliss engines, 3 Babcock & Wilcox water tube boilers, and etc.

Exhaustive tests of the finished product show their cement to be of the highest possible grade and their "OK" brand, named in honor of the new State of Oklahoma, will rank with the best.

The Company has booked orders for over 30 days run of the mill in addition to a goodly number of contracts running through the season.

Mobile Portland Cement Co., capital stock \$1,750,000, which is to erect a mill on the Tombigbee River, Alabama, seventy miles above Mobile, will build in reinforced con-



El Oro Tube Mill Lining.

the pebbles which do the grinding also form the lining of the mill, the rough surface presented by the rows of pebbles prevent the sliding motion of the mass at the base, causing the pebbles to be lifted higher than is possible in a smooth lining, especially on wet materials, 17 of these pebble lined mills are in operation at the Compania Minerva Las Dos Estrellas and the El Oro Mining & Railway Co., at El Oro, Mexico, where 4 by 5 tube mills charged with 20,200 pounds of pebbles lasted 10 months. The El Oro Tube Mill lining is furnished and installed by Blaisdell Co., 334 Pacific Building, Los Angeles, Cal.

The Oklahoma Portland Cement Company, located at Ada, Okla., is now shipping cement, having fin-

crete; 125 ft. kilns will be installed; all of the machinery is to be electrically driven. Barges will be used to ship cement from the plant to Mobile. The officers of the company are as follows: Edward L. Russel, chairman of the board of directors, Leopold Hammel, P. J. Lyons, William W. Thompson, S. Lowenstein, all of Mobile, and John R. Markley, Chicago, Ill. The offices of the company are at Mobile, Ala., with a branch office in the Marquette building, Chicago, Ill.

The Wilson Reinforced Concrete Co., of Omaha, Neb.; capital \$25,000; president, John J. Gillingham, of Falls City; Charles H. Busch, Nebraska City, Neb., with headquarters at Omaha.

SPECIFICATIONS FOR HOLLOW CONCRETE BLOCK.

Proposed by the Committee on Standard Specifications.

E. S. Larned, C. E., Chairman. To be Submitted to National Association of Cement Users' 1908 Convention.

Concrete Hollow Blocks made in accordance with the following specifications, and meeting the requirements thereof, may be used in building construction, subject to the usual form of approval, required of other materials of construction, by the Bureau of Building Inspection.

1. Cement.

The cement used in making sand blocks shall be Portland cement, capable of passing the requirements as set forth in the "Standard Specifications for Cement," by the American Society for Testing Materials.

2. Sand.

The sand used shall be suitable siliceous material, passing the one-fourth inch mesh sieve, clean, gritty, and free from impurities.

3. Stone or Coarse Aggregate.

This material shall be clean broken stone, free from dust, or clean screened gravel passing the three-quarter ($\frac{3}{4}$) inch, and refused by the one-quarter ($\frac{1}{4}$) inch mesh sieve.

4. Unit of Measurement.

The barrel of Portland cement shall weigh 380 pounds net, either in barrels or sub-divisions thereof, made up of cloth or paper bags, and a cubic foot of cement shall be called not to exceed 100 pounds or the equivalent of 3.8 cubic feet per barrel. Cement shall be gauged or measured either in the original package as received from the manufacturer, or maybe weighed and so proportioned; but under no circumstances shall it be measured loose in bulk.

5. Proportions.

For Exposed Exterior or Bearing Walls: (a) Concrete Hollow Blocks, machine made, using a semi-wet concrete or mortar, shall contain one (1) part cement to not exceed three (3) parts sand and four (4) parts stone, of character and size before stipulated. When the stone be omitted, the proportion of sand shall not be increased. (b) When said blocks are made of slush concrete, in individual moulds and allowed to harden undisturbed in same before removal, the proportions may be one (1) part cement to not exceed three (3) parts sand and five (5) parts stone, but in this case also, if the stone be omitted the proportion of sand shall not be increased.

When less sand or less stone, than in clauses (a) and (b) be used

to produce special blocks, the ratio of sand to stone shall not be less than 0.50.

6. Mixing.

Thorough and vigorous mixing is of the utmost importance.

(a) Hand Mixing. The cement and sand in correct proportions shall first be perfectly mixed dry, the water shall then be added carefully and slowly in proper proportions, and thoroughly worked into and throughout the resultant mortar; the moistened gravel or broken stone shall then be added, either by spreading same uniformly over the mortar, or spreading the mortar uniformly over the stones, and then the whole mass shall be vigorously mixed together until the coarse aggregate is thoroughly incorporated with and distributed throughout the mortar.

(b) Mechanical Mixing. Preference shall be given to mechanical mixers of suitable design, and adapted to the particular work required of them; the sand and cement, or sand and cement and moistened stone shall however, be first thoroughly mixed before the addition of water, and then continued until the water is uniformly distributed or incorporated with the mortar or concrete:—Provided, however, that when making slush or wet concrete (such as will quake or flow) this procedure may be varied with the consent of the Bureau of Building Inspection, architect or engineer in charge.

7. Moulding.

Due care shall be used to secure density and uniformity in the blocks by tamping or other suitable means of compression. Tamped blocks shall not be finished by simply striking off with a straight edge, but, after striking off, the top surfaces shall be trowelled or otherwise finished to secure density and a sharp and true arris.

8. Curing.

Every precaution shall be taken to prevent the drying out of the blocks during their initial set and first hardening. A sufficiency of water shall first be used in the mixing to perfect the crystallization of the cement, and, after moulding, the blocks shall be carefully protected from wind-currents, sunlight, dry heat or freezing, for at least five (5) days, during which time additional moisture shall be supplied by approved methods, and occasionally thereafter until ready for use.

9. Ageing.

Concrete hollow blocks in which the ratio of cement to sand be one-third (1-3), (one part cement to three parts sand) shall not be used

in the construction of any building in the (City) of (Town) of until they have attained the age of at least three (3) weeks.

Concrete hollow blocks in which the ratio of cement to sand be one-half ($\frac{1}{2}$) (one part cement to two parts sand) may be used in construction at the age of two (2) weeks, with the special consent of the Bureau of Building Inspection and the architect or engineer in charge.

Special blocks of rich composition, required for closures may be used at the age of seven (7) days with the special consent of the same authorities.

The time herein named, is conditional, however, upon maintaining proper conditions of exposure during the curing period.

10. Marking.

All concrete blocks shall be stamped (in process of making) for purposes of identification, showing name of manufacturer or brand, date (day, month and year) made, and composition or proportions used, as, for example, 1-3-5, meaning one cement, three sand and five stone.

11. Thickness of Walls.

The thickness of bearing walls for any building where concrete hollow blocks are used, may be ten (10) per cent less than is required by law for bricks walls. For curtain walls, or partition walls the requirements shall be the same as in the use of hollow tile, terra cotta or plaster blocks.

12. Party Walls.

Hollow concrete blocks shall not be permitted in the construction of party walls, said walls must be built solid.

13. Walls—Laying of.

Where the face only is of hollow concrete block, and the backing is of brick, the facing of hollow block must be strongly bonded to the brick either with headers projecting four (4) inches into the brick work, every fourth course being a heading course, or with approved ties; no brick backing to be less than eight (8) inches. Where the walls are made entirely of concrete blocks, but where said blocks have not the same width as the wall, every fifth course shall extend through the wall, forming a secure bond. All walls, where blocks are used, shall be laid up with Portland cement mortar.

14. Girders or Joists.

Wherever girders or joists rest upon walls so that there is a concentrated load on the block of over two (2) tons, the blocks supporting the girder or joists must be made

solid for at least eight (8) inches from the inside face. Where such concentrated load shall exceed five (5) tons, the blocks for at least three courses below, and for a distance extending at least eighteen (18) inches each side of said girder, shall be made solid for at least eight (8) inches from the inside face. Wherever walls are decreased in thickness, the top course of the thicker wall shall afford a full solid bearing for the webs or walls of the course of blocks above.

15. Limit of Loading.

No wall, nor any part thereof, composed of concrete hollow blocks, shall be loaded to an excess of eight (8) tons per superficial foot of the area of such blocks, including the weight of the wall, and no blocks shall be used in bearing walls that have an average crushing at less than 1,000 pounds per sq. in. of area, at the age of twenty-eight (28) days; no deduction to be made in figuring the area for the hollow spaces.

16. Sills and Lintels.

Concrete sills and lintels shall be reinforced by iron or steel rods in a manner satisfactory to the Bureau of Building Inspection, or the architect or engineer in charge, and any lintels spanning over four feet, six inches shall rest on block solid for at least eight inches from the face next the opening and for at least three courses below the bottom of the lintel.

17. Hollow Space.

The hollow space in building blocks, used in bearing walls, shall not exceed the percentage given in the following table for different height walls, and in no case shall the walls or webs of the block be less in thickness than one-fourth their height. The figures given in the table represent the percentage of such hollow space for different height walls.

Stories	1st	2nd	3rd	4th	5th	6th
1 and 2	33	33				
3 and 4	25	33	33	33		
5 and 6	20	25	25	33	33	33

18. Application for Use.

Before any such material be used in buildings, an application for its use and for a test of the same must be filed with the Bureau of Building Inspection. In the absence of such a Bureau the application shall be filed with the chief of any department having such matters in charge. A description of the material and a brief outline of its manufacture and proportions used must be embodied in the application. The name of the firm or corporation, and the responsible officers thereof,

shall also be given, and changes in same thereafter promptly reported.

19. Preliminary Test.

No hollow concrete blocks shall be used in the construction of any building unless the maker of said blocks has submitted his product to the full tests required herein, and placed on file with the Bureau of Building Inspection, or other duly authorized official, a certificate, from a reliable testing laboratory, showing that representative samples have been tested and successfully passed all the requirements hereof, and giving in detail the results of the tests made.

No concrete blocks shall be used in the construction of any building until they have been inspected and approved, or, if required, until representative samples be tested and found satisfactory. The results of all tests made, whether satisfactory or not, shall be placed on file in the Bureau of Building Inspection. These records shall be open to inspection upon application, but need not necessarily be published.

20. Additional Tests.

The manufacturer and user of such hollow concrete blocks, or either of them, shall, at any and all times, have made such tests of the cements used in making such blocks, or such further tests of the completed blocks, or of each of these, at their own expense, and under the supervision of the Bureau of Building Inspection, as the chief of said Bureau shall require.

In case the result of tests made under this condition should show that the standard of these regulations is maintained, the certificate of approval, issued to the manufacturer of said blocks, will at once be suspended or revoked.

21. Certificate of Approval.

Following the application called for in clause No. 18, and upon the satisfactory conclusion of the tests called for, a certificate of approval shall be issued to the maker of the blocks by the Bureau of Building Inspection. This certificate of approval will not remain in force for more than four months, unless there be filed with the Bureau of Building Inspection, at least once every four months following, a certificate from some reliable physical testing laboratory showing that the average of at least three (3) specimens tested for compression, and at least three (3) specimens tested for transverse strength, comply with the requirements herein set forth. The said samples to be selected by a building inspector, or by the Laboratory, from blocks actually going into construction work.

22. Test Requirements.

Concrete hollow blocks must be subjected to the following tests: Transverse, Compression and Absorption, and may be subjected to the Freezing and Fire tests, but the expense of conducting the Freezing and Fire tests will not be imposed upon the manufacturer of said blocks.

The test samples must represent the ordinary commercial product, of the regular size and shape used in construction. The samples may be tested as soon as desired by the applicant, but in no case later than sixty days after manufacture.

Transverse Test. The modulus of rupture for concrete blocks at 28 days must average one hundred and fifty, and must not fall below one hundred in any case.

Compression Test. The ultimate compressive strength at 28 days must average one thousand (1,000) pounds per square inch, and must not fall below seven hundred in any case.

Absorption Test. The percentage of absorption (being the weight of water absorbed, divided by the weight of the dry sample) must not average higher than 15 per cent, and must not exceed 22 per cent in any case.

23. Condemned Block.

Any and all blocks, samples of which, on being tested under the direction of the Bureau of Building Inspection, fail to stand at twenty-eight (28) days the tests required by this regulation, shall be marked condemned by the manufacturer or user and shall be destroyed.

24. Cement Brick.

Cement brick may be used as a substitute for clay brick. They shall be made of one part cement to not exceeding four parts clean sharp sand, or one part cement to not exceeding three parts clean sharp sand and three parts broken stone or gravel passing the one-half inch and refused by the one-quarter inch mesh sieve. In all other respects, cement brick must conform to the requirements of the foregoing specifications.

The Nazareth Cement Co. has posted notices stating that the mill will resume February 3rd, with a full force.

W. L. Holmes of Detroit, Mich., president of the Ohio Portland Cement Co., is reported to have purchased the Hamden Furnace property, near Wileston, Ohio, consisting of 2,500 acres of land, upon which a large Portland cement plant

is to be built, under a West Virginia charter.

The Sandusky Portland Cement Co., of Sandusky, O., manufacturers of Medusa Water-proof Compound, report that the material was used in the following work:

In the cement jacket on the 850,000 gallon concrete standpipe being built at Grand Rapids, Mich.; in the tunnel work at St. Paul, done by the Twin City Rapid Transit Co.; in the Art Stove Company and Bell Telephone Company contracts at Detroit, Mich.; in a cold storage tank constructed by the Alger Coal Co., Alger, Wyo.; in a concrete tank constructed by the Turner Bros. Brass Works, Sycamore, Ill.; in a section of the concrete roof for the Chicago City Railway, Chicago, Ill., and by the C. M. & St. P. Ry. Co. in concrete construction work.

Asphalt pavements were invented in Paris, under Napoleon III, who requested his engineers to provide a pavement that could not be torn up and used as barricades by the mob, which was the case with block pavements. The Neufchatel asphalt being used in the first Paris asphalt pavements.

INCORPORATED.

The Diamond Cement Machine company, of Toledo, Ohio was incorporated recently, with \$10,000 capital stock, by J. G. Gubbill, H. J. Chittenden, Charles E. Chittenden, Charles Rothgert and John Vogt. They will make cement block machines.

George A. Anderson, C. H. Anderson and L. F. Anderson, are the incorporators of the Fargo Concrete Co., of Fargo, N. Dak., capitalized at \$5,000.

The company will engage in the manufacture of concrete blocks, fence posts and tiles, a line of construction material not yet made here. The company has leased the south corner of the Interior Lumber Co. yard, and the active management will be in charge of C. H. Anderson.

The American Concrete Machinery Company of Guthrie and Youngstown, Ohio; capital stock, \$50,000. Directors, C. J. Hostetter and William Bayers of Youngstown, and H. W. Pentecost, of Guthrie, Okla.

J. C. Fisher, of Okeene, Okla., is promoting a cement company which is to erect a plant near Okla-

homa City, where the company is to be financed; the fuel is to be gas piped from Okeene to Oklahoma City. Mr. Fisher is a little wild in his estimates on the cost of a 2,000 barrel cement mill, which he places at \$200,000. With gas fuel one hundred miles away, this is a case of the blind leading the blind.

The Nebraska Cement Workers' Association will meet in Lincoln, Nebraska, February 4, 5, and 6, at the Temple. Machinery and cement products will be on display.

The Chicago Portland Cement Co. which closed down for alterations and repairs in December, will start up January 24th with a full force and large increased output.

The Sandusky Portland Cement Company's plant at Syracuse, Ind., will start up January 13th with a full force.

The Huron Portland Cement Plant at Alpena, Mich., now under construction, is to be completed by April 1st, under rush orders in order to fill large contracts taken by H. J. Parton for 200,000 barrels of cement, according to statements of the local press. The Wyandotte Portland Cement Co. which is controlled by the same company, has orders booked that will keep it busy during the coming season.

The report that the Millen Portland Cement Co. would remove its plant to some other location is unfounded.

The American Hydrolith Company of New York, has been incorporated, with a capital stock of \$100,000, for the purpose of manufacturing cement, cement blocks, etc., by William Otis Badger, Robert Van Iderstein, Wendall P. Barker, No. 100 William street, New York City, and others.

Work on the Portland Cement Plant under way at Harvey, Iowa, has been suspended until March. Materials for track-laying, switches, ties and rails, are still coming in. A small amount of grading from the plant site to the quarries is being done.

The Hecla Cement Co. expects to start up February 1st, with a force of 140 men. There being sufficient cement in the stock house to supply the demand up to the opening of navigation.

WAHSATCH PORTLAND CEMENT CO.

At a meeting of the Wahsatch Portland Cement Company, in which a number of Grand Rapids, Mich., business men are interested, held in New York recently the following officers were elected: President, H. C. Baker, Ogden, Utah; vice-president, A. T. Thoits, Grand Rapids; secretary and treasurer, F. J. Randolph, New York; directors, A. S. Hicks, Grand Rapids; H. K. Dean, Grand Rapids; J. B. Mocgridge, Newark, N. J.; J. G. Gronberg, Grand Rapids, and Arthur Waldradt, New York. The property of the company is located in Box Elder county, Utah, on the lines of both the Southern Pacific and Oregon Short Line railways.

Careful estimates based upon a canvas of dealers in building materials in Chicago, fixes the amount of cement consumed in this city at about 5,500,000 barrels during 1907 cement sold as high as \$1.75 per barrel and as low as \$1.20 per barrel, with an average price of \$1.65 per barrel, or \$8,075,000 for the season.

The freight charges on a single car of cement, 40 tons, from Iola to Fort Yuma, Arizona, was \$1,000.

The Blount Mountain Portland Cement Company's new plant at Village Springs, Ala., will consist of a crusher-house of frame, 70x100 feet; drier-house of steel, 56x100 feet; raw mill of brick and steel, 102x145 feet; kiln-house of steel, 148x161 feet; finishing mill of brick and steel, 102x145 feet; coal-grinding mill, 36x110 feet; machine shop, 50x30 feet; store-house, 50x30 feet; carpenter shop of brick and steel, cement tile roof, 30x30 feet; engine-house of brick and steel, cement tile roof, 50x154 feet; boiler-house, 38x154 feet; etc. The offices of the company are in the Nazareth National Bank Building, Nazareth, Pa.

Wellston, O.—The Ohio Cement Company has acquired a large site near Wellston, and is planning the erection soon of a Portland cement plant with a daily capacity of 3,000 barrels. W. I. Holmes, of Detroit, is president.

The Lawrence Cement Co. has commenced work in its quarries, with the intention of starting up its entire plant, in which the force had been cut down to 25 per cent. Other plants are preparing to resume.

The Ash Grove Portland Cement Co. whose plant is under construction at Chanute, Kans., has struck a 30,000,000 cubic feet gas well on Dec. 27, 1907, at the depth of 838 feet striking a 20 ft. strata of sand. The well is being capped and connected with the Gas Belt Fuel Company's mains.

The work on the Iowa Portland Cement plant at Des Moines has been stopped on account of weather conditions. Work will be resumed in the spring.

The city of Chicago is after the new government material testing plant which is to be located in the near future at some convenient point in the middle west.

Birmingham, Ala.—The Blount Mountain Portland Cement Company has been organized in the east with a capitalization of three million dollars and specifications and plans have been drawn for the erection of a plant to manufacture Portland cement at Village Springs, Ala., twenty-two miles north of Birmingham on the Birmingham Mineral railroad. The plant will cost \$830,000, and it is announced that contracts have been drawn for the actual construction of the buildings, the same to be completed and in operation by August of this year. There is a great amount of stone in the vicinity of Village Springs suitable, it is asserted, for the manufacture of cement. The daily capacity of the plant will be three thousand barrels. William B. Shaffer, of Nazareth, Pa., will be director and general manager, the executive offices of the company being located in New York. The cement industry in the south and in Alabama is developing at a great rate, the plant of the Leeds Company, in the northeastern part of Jefferson county, less than twenty-five miles from Birmingham, being a big success from the start, as were the plants in operation near Demopolis, in Marengo county.

The Southwestern Portland Cement Co. of El Paso, Texas, has removed its offices from the city to the site of its proposed plant just north of El Paso, where a building has been erected to be used jointly as a laboratory and office building. Tests of the company's materials are being made by O. J. Binford, secretary and chemist of the company.

BOOK NOTICES.

MUNICIPAL REPAIR PLANT.

51 pages 11 1-2 inches by 9 illustrated, first annual report by W. J. Hardee, City Engineer.

This is a valuable report covering the cost of building of the municipal repair plant and installation of machinery, tools, wagons, horses and laboratory, with cost of operation for one year. The history of pavements in New Orleans, cost of maintenance, and repairs by contract, and the same work by the city repair gang. The first asphalt pavements were commenced in 1883 and finished in 1884, laid on a 6 inch concrete foundation 1-2 inch binder, and 2 inch wearing surface at \$3.50 per sq. yard, with a guarantee of 20 years. After May 1887 the guarantee on new contracts was limited to 5 years, the contract price being cut to \$3.25 per sq. yard. On June 1905. Bids were received for making all the repairs on asphalt pavements in the City; the lowest bid on 297,226 sq. yards was \$114,500. All bids were rejected, and the City proceeded to erect its own repair plant at the cost of \$48,365.37. The equipment, installation of machinery, horses, wagons, laboratory cost \$17,643.45, or \$66,008.82 complete. The repair work done by the city in one year ending in August, 1907 covered substantially the same work for which bids had been received in 1905 amounting to \$114,500 for 297,226 sq. yards of asphaltum repairs. The City did this work from its own repair plant for \$48,365.37, at the rate of \$11.44 cents per sq. yard against 38 1-2 cents per sq. yard which it would have paid under the lowest bids received of \$114,500 for the same work. The total cost at 11.44 cents per sq. yard was \$40,306.83, resulting in a saving of \$74,193.17 which paid for the entire plant and equipment leaving a surplus of \$8,184.35 over the cost of plant and equipment in a single year's operation under the direction of City engineer W. J. Hardee, who has given great latitude in the operation of the plant, which during the first year's operation was devoted almost exclusively to the repair of asphalt street pavements. This report should be in the hands of all municipal authorities contemplating doing their own repair work.

Field System. By Frank B. Gilbreth; 200 pages, illustrated. Price, \$2.00. Published by The Myron C. Clark Publishing Co., Chicago, Ill.

This book embodies Frank B. Gilbreth's rules and instructions to his superintendents and foremen, during the past 20 years' ex-

perience as a general contractor in construction work of the largest magnitude with many jobs under way at one and the same time in various parts of the country. These rules and instructions are now embodied in a work known as "Gilbreth's Field System," upon which the foundations of his success as one of the most extensive contractors is based.

ENGINEERING EXPERIMENT STATION UNIVERSITY OF ILLINOIS.

Bulletin No. 15 of the Engineering Experiment Station, "How to Burn Illinois Coal Without Smoke," by L. P. Breckenridge, Director of the Engineering Experiment Station, has just been issued.

A few pages are devoted to the principles of combustion and the losses due to smoking chimneys, but the larger part of the bulletin relates to the constructive features of those boiler settings and furnaces that have been found practically smokeless in operation at the power plant and in the Experiment Station at the University of Illinois.

The leading dimensions of the settings and furnaces are given and sectioned cuts show the general character of the settings. With each cut is given a statement as to the range of capacity of each setting for smokeless operation.

Especial emphasis is given to the importance of knowing the rate at which the coal is to be burned on each square foot of grate surface together with the per cent of volatile combustible which the coal contains, and for which a suitable combustion space or chamber must be provided. Some interesting cuts are produced showing clearly the significance of the numbers used in describing smoke densities, and also a chart devised for making graphic records of smoke observations. Five tables of tests are given showing the conditions of operation of a smokeless furnace under changes of boiler capacity varying from 50 to 150 per cent. There are no illustrations showing approved settings for the horizontal fire tube boiler but suggestions are given as to methods of hand firing which will tend to reduce smoke production.

While this bulletin discusses the smokeless burning of Illinois Coals, the principles and methods explained apply equally well to the burning of all kinds of soft coal.

Copies of this bulletin may be obtained gratis upon application to the Director, Engineering Experiment Station, Urbana, Illinois.

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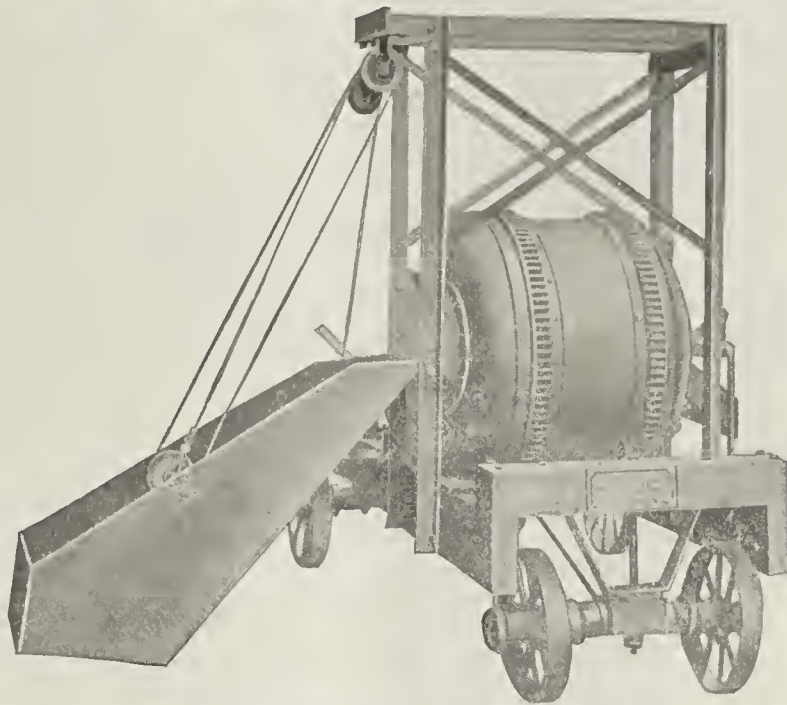
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Concrete and Reinforced Concrete Construction. By Homer A. Reid. 906 pages, 715 illustrations. Price, \$5.00. Covers the latest development in tests, theory and practice of concrete and reinforced concrete construction, including many new and original data never before published.

Cement and Concrete. By Louis C. Sabin. Second Edition. 583 pages, 161 tables of tests. Price, \$5.00.

Reinforced Concrete. By A. Considere. Translated from the French by Leon S. Moisseiff. Second Edition, 253 pages, 32 illustrations. Price, \$2.00.

Reinforced Concrete. By A. W. Buel and C. S. Hill. Second Edition, 500 pages, 340 illustrations. Price, \$5.00.

A mathematical discussion and practical consideration of construction in reinforced concrete.

Reinforced Concrete. By Charles F. Marsh and William Dunn. (English). Third Edition, 660 quarto pages, 617 illustrations. Price, \$7.00.

A theoretical and practical discussion of concrete structures.

Architects' and Engineers' Handbook of Reinforced Concrete Construction. By L. J. Mensch, 217 pages, 172 illustrations, many tables. Price, \$2.00.

Gives in simple language without the use of mathematics an exposition of the essential features of concrete construction.

Concrete Steel. A treatise on the theory and practice of reinforced concrete construction. By W. N. Twelvetrees. (English). 230 pages, 73 illustrations. Price, \$1.90. New Edition, ready shortly.

Graphical Handbook for Reinforced Concrete Design. By John Hawkesworth. C. E. Quarto, 70 pages, 15 large folding plates. Price, \$2.50.

Brayton-Standards for the Uniform Design of Reinforced Concrete. By Louis F. Brayton. Second Edition. Leather, pocketbook size. 110 pages, illustrated. Price, \$3.00.

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A chemical and mineralogical study of cement composition.

Practical Cement Testing. By W. Purves Taylor, Engineer in charge Philadelphia Municipal Testing Laboratories, 315 pages, 142 illustrations, 58 tables. Price, \$3.00.

Portland Cement—Composition, Raw Materials, Manufacture, Testing and Analysis. By Richard K. Meade, B. S. 385 pages, 100 illustrations. Price, \$3.50.

Principles of Reinforced Concrete Construction. By Turneaure & Maurer. 8vo, viii + 317 pages. Cloth, \$3.00.

Hollow Concrete Block Building Construction. By Spencer B. Newberry. 25 pages, illustrated. Price, 50 cents.

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Field System. By Frank B. Gilbreth, 200 pages with illustrations, bound in leather. Price, \$3.00.

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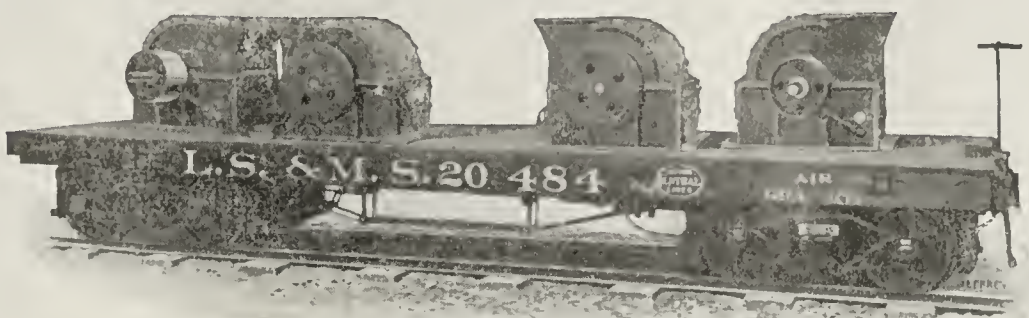
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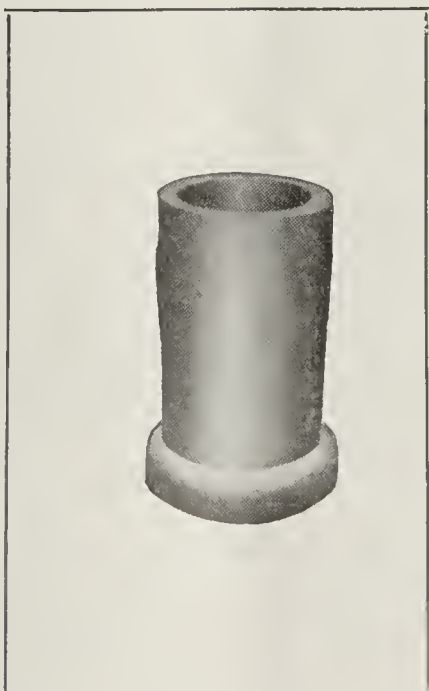
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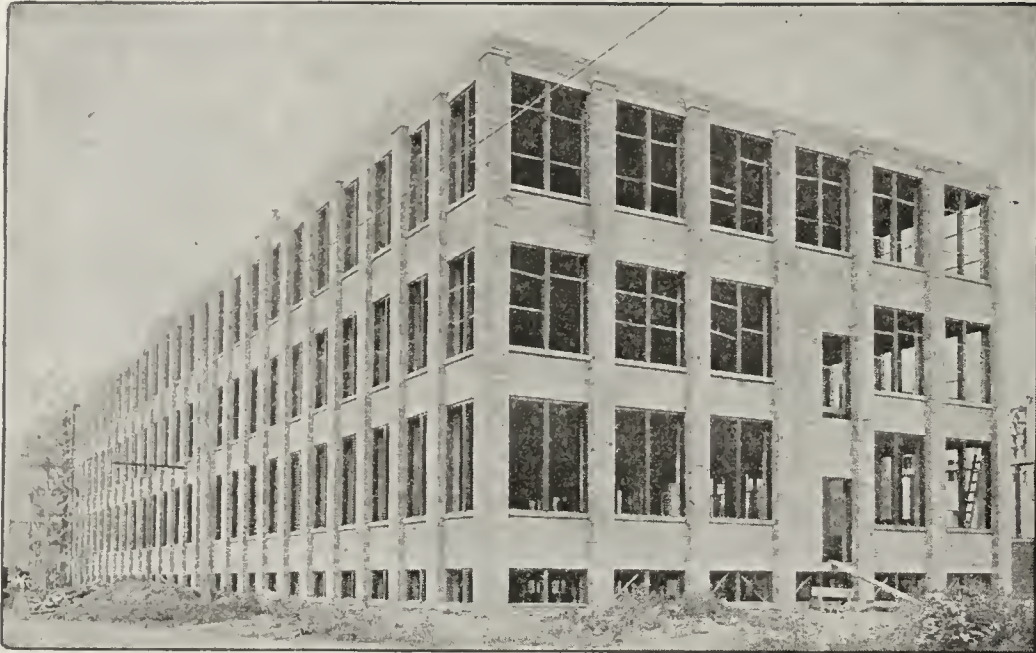
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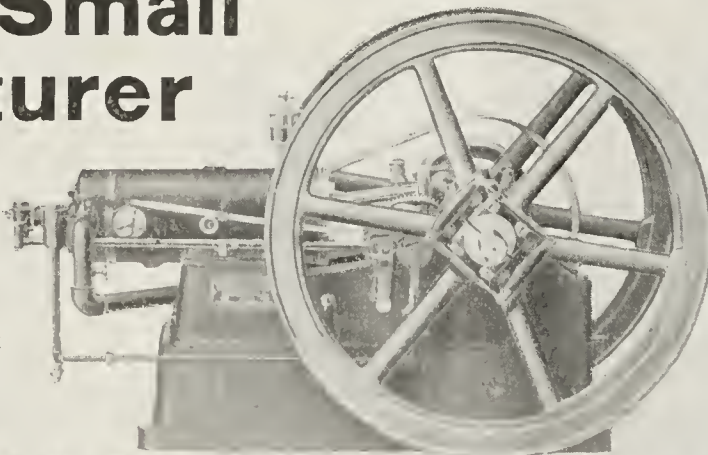
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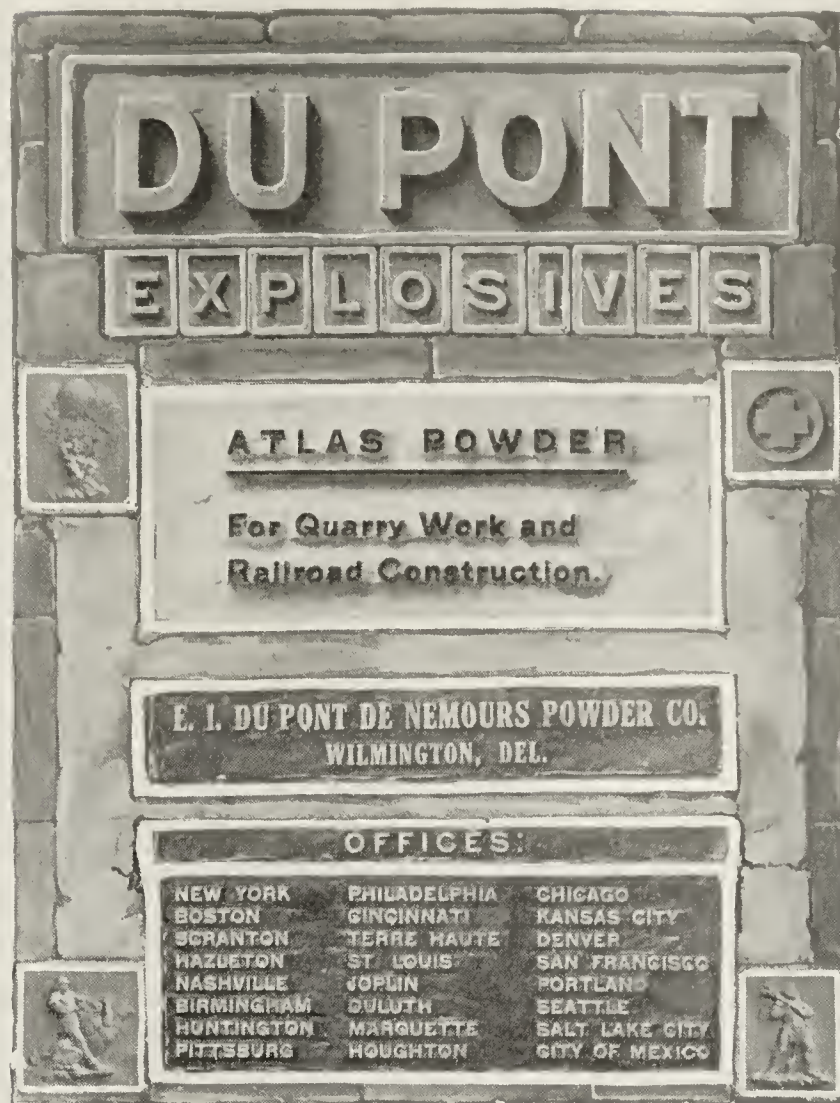
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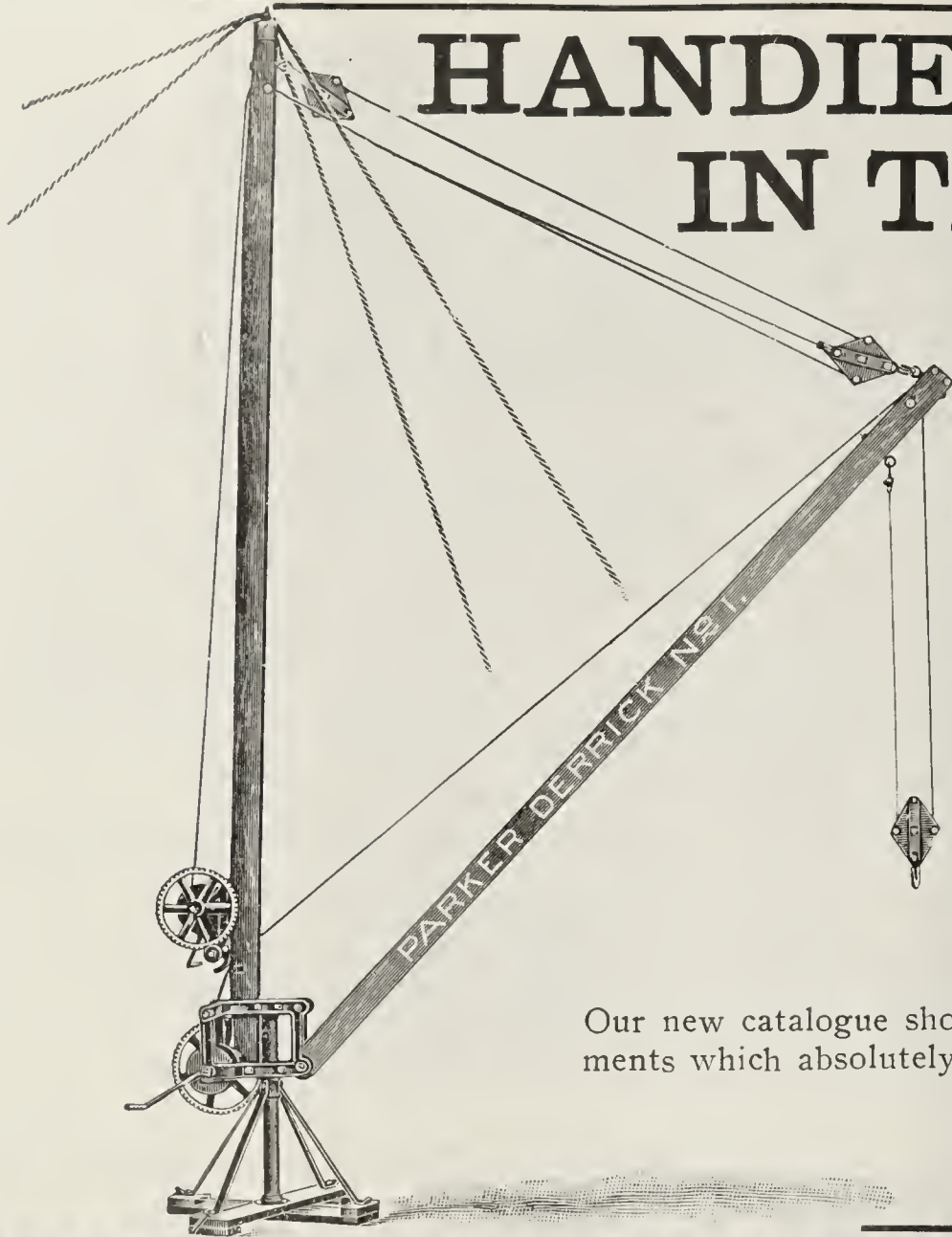
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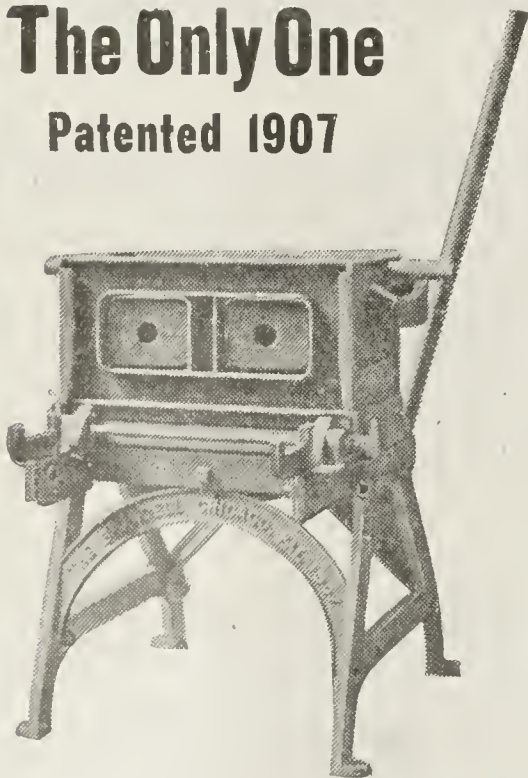
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ENGINEERING NEWS



Fig. 4. See Page 36 for Description.

FIREPROOF WAREHOUSE

Constructed on the Mushroom System of Reinforced Concrete Construction at
Evanston, Ill.—Alling Construction Co., Chicago, Contractors.

CEMENT AND ENGINEERING NEWS

(PUBLISHED MONTHLY)

WILLIAM SEAFERT, Editor and Publisher

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JOHN F. WALDRON, Advertising Manager

CHICAGO, FEBRUARY, 1908.

CORRESPONDENCE.

We solicit correspondence on all matters of general interest to the cement trade in all its branches. Engineering notes, public improvements, and facts and opinions drawn from practical experiments will be welcome.

CEMENT FOR THE PANAMA CANAL.

It has been officially stated by the United States government that 4,500,000 bbls. of cement will be used in the construction of the Panama Canal, now under way. This is less than one-half of the estimates made by previous chief engineers on the work. Considering the fact that the width of the locks are to be fully 1-3 wider than under the previous estimates, the present estimate comes as a surprise. Even this reduced estimate is not to be given to American Portland Cement producers. The inspired hint given by the United States Geological survey in its press bulletin, which is to be released Feb. 24th, states that the Portland cement specifications when issued will limit the alumina contents of the cement to such an extent, as to bar out most of the Portland cements now manufactured in the United States. This simply means that the Sedro or iron ore Portland cement will be specified, the patents for which are owned by the Krupp Company of Essen, Germany. This cement is said to be sea proof. Yet the greatest percentage of concrete masonry at Panama, will be done above the sea level, then why eliminate cement of an American manufacture as a whole, when it will answer every purpose for inland work, on the great dams and locks, etc. The American people are footing the bills. Why not then use domestic Portland cement. The American cement

plants now have a capacity of 60,000,000 bbls. annually, with an output of 48,000,000 bbls. only in 1907. This is 12,000,000 bbls. below our existing capacity. We raise barriers against products of foreign manufacture by a protective tariff. Why let down the bars and reverse the principle in the case of this one commodity only, that of Portland cement.

CEMENT MANUFACTURERS FORM AN ASSOCIATION AND TERMINATE PATENT LITIGATION.

The Association of Licensed Cement Manufacturers was organized in New York on January 9th by the North American Portland Cement Company, the Atlas, Alpha, American, Lehigh, Lawrence, and Vulcanite Portland cement companies, and various other important companies in the East and West, including the Dexter, Edison, Nazareth, Pennsylvania, Penn-Allen, and Catskill, all of which have secured licenses under the Hurry and Seaman, Edison, Carpenter, and other patents controlled by the North American company. Other applications for membership have been presented and are under consideration. The officers of the Association are A. F. Gerstell, vice-president and general manager of the Alpha Portland Cement Co., president; Conrad Miller, president of the Dexter Portland Cement Co., vice-president; and Alfonso De Navarro, vice-president of the Atlas Portland Cement Co., secretary and general manager.

The purposes of the Association include the general betterment of the mechanical and chemical processes used in making cement, the improvement of the quality of cement, dealing with matters of traffic and shipment and the establishment of an Association laboratory for technical tests and experiments. It is understood that all existing and properly equipped cement plants will be granted licenses and admitted to membership. Infringers of the patents above referred to will be rigorously prosecuted.

Nearly 70 per cent of the output of the Portland cement industry in this country is already represented by the Association, this being double the annual production in Great Britain, the pioneer Portland cement manufacturing country equal to the combined output of England and France, and in excess of that of Germany.

In the '80's, a few far-sighted

American manufacturers undertook to manufacture Portland cement on a large scale, employing the vertical or bottle kiln method then in use in Europe. This method was so obviously imperfect mechanically, however, that the growth of the industry was very slow. In 1890, the production of Portland cement in the United States was less than 400,000 barrels, nearly all of the cement consumed in this country, about 2,500,000 barrels, being imported.

Some manufacturers then experimented with and adopted the inclined rotary kiln—a long rotating firebrick lined cylinder set at a slight angle from the horizontal, into the upper end of which was fed the powdered raw material which was gradually worked down to the lower end against a flame of oil which calcined the material into clinker. But the high and fluctuating price of oil rendered this mechanically perfect method of doubtful commercial value.

In 1895 and 1896, however, Hurry and Seaman, engineers of the Atlas Portland Cement Company, devised and put into successful use apparatus for burning pulverized coal in rotary kilns. Coal was cheap and plentiful, and the cement industry was quick to recognize its opportunity. The effect of the Hurry and Seaman invention was revolutionary. During the next few years the growth of the trade was phenomenal. Oil was abandoned as fuel, and coal substituted. The old vertical kilns were dismantled and made over into rotary coal burning kilns. New plants went up like magic all over the country, all using rotary kilns and pulverized coal.

In 1897 the production of Portland cement in the United States amounted to 2,677,000 barrels. Since then the development has been even more rapid, the output in 1900 amounting to more than 8,000,000 barrels, and in 1906 exceeding 46,000,000 barrels. It is doubtful whether any other industry has shown so rapid a growth in this country. The Hurry and Seaman invention was introduced into England and in other countries of Europe with equally remarkable results, vertical kilns being practically abandoned in favor of rotary kilns using coal.

Meanwhile, Hurry and Seaman obtained a patent on their invention and the Atlas company undertook to assert their rights thereunder. For years the industry resisted until finally a test suit was brought to a hearing, before the U. S. Court at Scranton, Pa., in 1906, with the

Alpha Portland Cement Company as defendant. Testimony had been taken in all parts of this country and in Europe, the most noted cement experts and manufacturers acting as witnesses. Six years were spent in preparation for the suit. When the case was argued officers and attorneys of the leading cement companies crowded the court room.

The case was not allowed to go to judgment, however, as immediately after the hearing a number of the most important companies of the Lehigh region, including the defendant, came to terms by agreeing to take out licenses recognizing the Hurry and Seaman patent and to pay substantial royalty.

The North American Portland Cement Company was organized in the latter part of 1906, with a capital stock of \$10,000,000, having among its purposes the taking over from the Atlas company of the Hurry and Seaman and other patents and the licensing thereunder of Portland cement manufacturers. During the past year the North American Company has been extremely active in prosecuting infringers of its patents and in acquiring other patents for the protection of its licensees.

Another marked advance in the cement industry was due to Thomas E. Edison, who devised new burning kilns, together with several unique methods of fuel consumption. In particular, he designed and had patented a rotary kiln 150 feet long, and 7 to 8 feet in diameter, having a daily capacity of from 700 to 1,000 barrels of cement. Until that time, the largest kilns in use were 60 to 80 feet long, 5 and 6 feet in diameter, with a capacity of but 200 barrels a day.

Edison's long kiln was universally ridiculed by the older manufacturers. But its success soon proved their criticism to be unwarranted. Once aware of its possibilities, cement manufacturers proceeded to avail themselves of the long kiln—without Mr. Edison's consent. More than one-half of the Portland cement now made in this country is produced in kilns of the Edison type. Old plants are lengthening their kilns wherever practicable and no wide-awake manufacturer building a cement plant today could afford to install kilns other than one hundred feet in length and upward.

The adoption of the long kiln by the Portland cement industry in general, and the consequent infringement of the exclusive patents held by Edison covering it, proved to be a fertile source of litigation which was only recently terminated

by the acquisition by the North American Company of the patents for long kilns, burners, and similar apparatus owned by Mr. Edison.

The Association of Licensed Cement Manufacturers, with its facilities for tests and experiments, its investigation of mechanical and chemical problems, its establishment of standards of quality, and its assistance in obtaining proper shipping facilities and rates is expected to be of great benefit to its members.

A REINFORCED CONCRETE STOCK HOUSE.

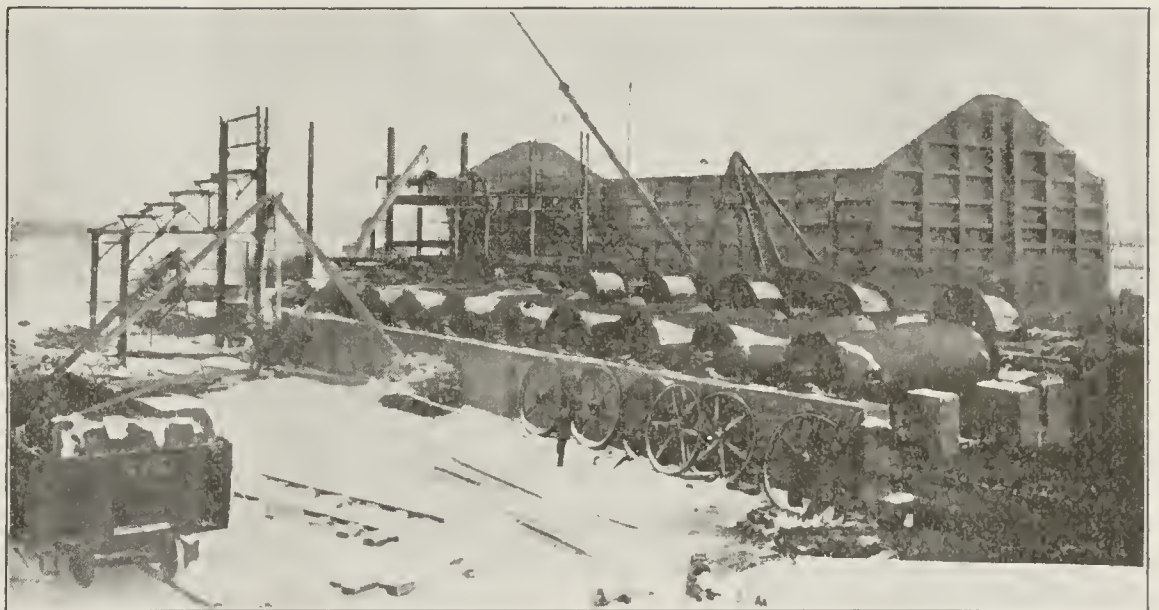
By A. Jordahl, Assoc. M. Am. Soc. C. E.

An interesting example of reinforced concrete construction is furnished by the large cement stock house, which is now being built as part of the new plant for the Vulcan Portland Cement Company, near Montreal, Canada.

Work on this plant, which will

crete and the floor of plain concrete resting on an earth filling. The roof has a pitch of 6 inches to the foot, and is constructed of steel trusses on 15 inch centers, steel purlins, wooden sheathing and composition roofing. It has a monitor extending the full length of the building. All interior walls are carried up to the same height as the side walls, while the gable walls extend 12 inches above the roof and form parapets. The stock house has a capacity of about 240,000 barrels for the storage and seasoning of cement in bulk.

The cement is conveyed from the cement mill by a belt conveyor to the stock house, entering the side of the monitor in the first bay from the end. It is here discharged into two 12 inch screw conveyors, running the entire length of the monitor, from which it is discharged through spouts into any desired bin or into the gallery. The cement is



Cement Stock House, Vulcanite Cement Co., Montreal, Canada.

have a daily capacity of 2,000 barrels, was commenced in May, 1907, and it will be ready for operation by March of this year.

All engineering and construction work was done by W. S. Barstow & Company, Engineers, New York.

The stock house, which is believed to be one of the largest in America, has the following out to out dimensions:

Width, 180 feet.

Length (excl. of packing houses), 245 feet three inches, and the height from ground to eaves is about 35 feet.

At each end there is a packing room 108 feet by 30 feet. The building is divided by a 10 foot wide gallery into two equal portions, each of which is subdivided into eight bins about 30 feet long and 49 feet wide C-C of columns. The walls and columns are of reinforced con-

crete and the floor of plain concrete resting on an earth filling. The roof has a pitch of 6 inches to the foot, and is constructed of steel trusses on 15 inch centers, steel purlins, wooden sheathing and composition roofing. It has a monitor extending the full length of the building. All interior walls are carried up to the same height as the side walls, while the gable walls extend 12 inches above the roof and form parapets. The stock house has a capacity of about 240,000 barrels for the storage and seasoning of cement in bulk.

The system of reinforcement adopted represents a novel departure from the usual practice of reinforced concrete construction. The column and beam reinforcement and the ties connecting the columns on opposite sides of the bins, are all of structural steel shapes with riveted connections and when erected

The aggregate used consisted of a fair quality of lime stone which was quarried and crushed on the job. It contained a large proportion of dust; for this reason all stone except for footings and floors was screened.

With the exception of the structural steel, plain round rods were used for reinforcement throughout.

All connections were riveted, pneumatic hammers being used for most of the work.

All steel which was to be embedded in concrete was left unpainted. The ties and the outside faces of partition channels were given two coats of paint in the shop.

DESIGN:

The adoption of the form of construction described above was prompted by the peculiar character of the building, as well as by local and labor conditions.

The cement pressure on the four sides of a bin produces bending moments, shear and direct tension in every beam and wall. Had rod reinforcement been used, the connections, in order to transmit these stresses, would necessitate a large amount of blacksmith work and bending.

Apart from the great expense which this would incur, it was considered doubtful whether connections of sufficient strength could have been effected, as the strength of bent rods, or hooks, is at the best an extremely uncertain item, especially when the work has to be performed in the field with unskilled labor.

On account of the poor quality of labor available for reinforced concrete work in Canada, and because the building was started so late in the season that its construction would have to be carried on under very unfavorable weather conditions, it was deemed necessary to design the building in such a way that there could be little or no possibility of poor and inaccurate workmanship.

It was also realized that the high walls, without any intermediate floors, would render the erection and alignment of forms extremely difficult and expensive, without some stiff skeleton frame on which to support these.

That the design decided upon met these various conditions admirably was fully substantiated during the construction of the building.

The lateral pressure on the walls was determined from Rankin's formula for surcharged walls by neglecting the friction and by assuming a constant angle of repose of the cement of 15 degrees and a weight of 100 lbs. per cu. ft.

It is of course realized that this method does not give exact results, because, among other things, cement has no constant angle of repose, but it was deemed sufficiently close for the purpose particularly in view of the many other uncertainties incident to the behavior of cement when in motion or at rest.

Experiments as well as practical experience seem to have demonstrated that the lateral pressure exerted by cement is greatest immediately after it has come to rest, indicating that in large bins, requiring several days to be filled, the pres-

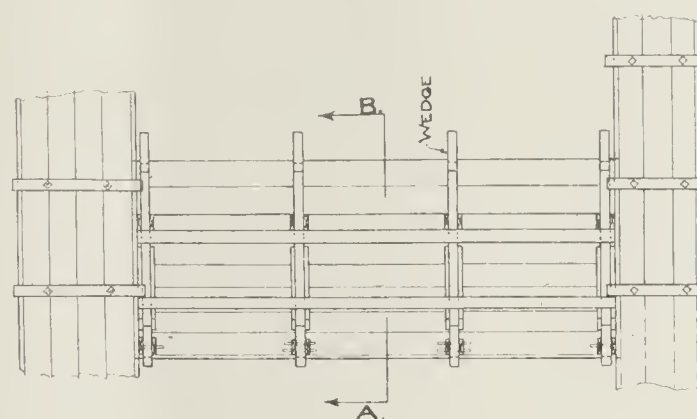
the maximum bending moment was taken as W. L.

12

The intermediate columns were figured as continuous beams, but the concrete casing was not considered to take any part of the bending stresses.

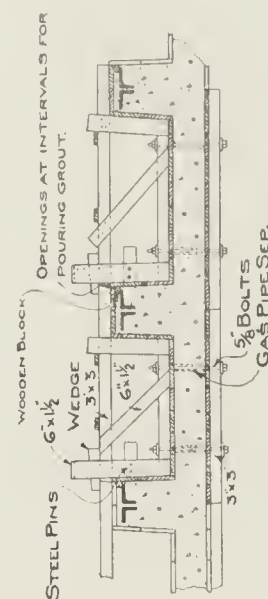
The beams in the outside and gallery walls were figured as T beams with 2-5 of the shortest and adjoining slab span as total width of compression flange.

The partition wall beams were not designed on the principle of rein-

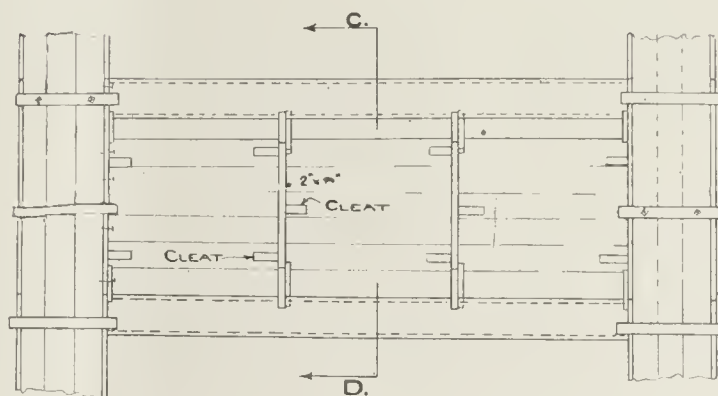


FORMS FOR OUTSIDE WALL.

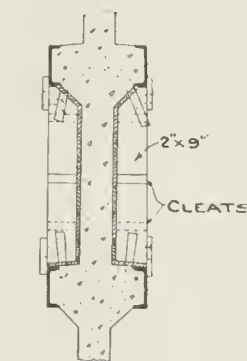
(ARRANGED SO THAT THE LOWER SECTIONS CAN BE REMOVED FIRST.)



SECTION A-B.



FORMS FOR PARTITION WALLS.



SECTION C-D.

DETAILS OF FORMS FOR STOCK HOUSE
VULCAN PORTLAND CEMENT CO., MONTREAL, CAN.
W. S. BARSTOW & CO. ENGINEERS & CONTRACTORS
NEW YORK

sure would be less than that given by the above method of figuring, for this reason it was deemed permissible to stress the concrete up to 700 to 800 lbs. per sq. inch in compression and 70 lbs. in shear and the steel to 18,000 to 20,000 lbs. per sq. inch. These stresses are somewhat higher than would otherwise have been used.

In the outside and gallery walls the bending moments on slabs and beams were figured as W. L. at the center and W. L. over the supports.

10

20

For the partition beams and slabs

forced concrete, but were treated as lattice girders with the steel channels acting as chords, and the through bolts and the concrete filling as web members.

In addition to the lateral pressure, the walls, columns and footings were figured for vertical loads composed of the live load on the roof, the weight of the structure and friction loads. The latter were based on an assumed co-efficient of friction of 0.55 for the plain walls and a somewhat higher value for those having ribs in contact with the cement.

Construction.

The forms for the concrete were made in a temporary carpenter shop erected for this purpose close to the stock house, and equipped with motor-driven saw and other necessary tools.

The reinforcing rods were ordered to length from the mill, and the little cutting required was done with a $1\frac{1}{2}$ inch rod shear. The stirrups and column binders were bent cold by a simple lever contrivance attached to a bench and operated by one man.

Forms were at first provided for one complete quarter section of the building, and it was the intention to use these till the job was completed. On account of weather conditions, it was afterwards decided to provide some additional forms and start operations at the other end of the structure. As a result of this, the first set of forms was actually used only three times.

The wall forms, typical cross-sections of which are shown, were made up on the ground into sections, each covering one entire wall panel, between adjacent beams and columns, including the corresponding column sides; the front and back of the columns were covered by separate sections.

The principal lumber used was $1\frac{1}{2}$ inch T. & G. hemlock, dressed one side.

The sides of columns and beams were battered $\frac{3}{4}$ inch to the foot to permit easy removal of the forms. All surfaces in contact with concrete were oiled.

Two guy derricks operating abreast on top of the steel frame, one on one side of the gallery, handled the forms as well as the concreting on three-fourths of the building. The remainder was built with a hoisting tower and one stiff-legged derrick, put up in order to complete the work before the severe frost set in.

The form sections for the outside face of wall were generally erected complete to the top and supported on the steel frame before any concreting was done. The reinforcing rods were then placed and held in position by means of wooden strips nailed to the outside forms, and provided with notches or holes for the rods. The inside forms were then erected section by section as the concreting progressed, and were held in position by pipe separators and bolts passing through the outside forms. The wooden spacers for the reinforcing rods were removed before the concreting reached them. The concrete was mixed with two

Batch mixers mounted on trucks and located on each side of the building between two successive positions of the derricks.

Two 14 cu. ft. contractors, tipping buckets operated by the guy derricks, transformed the concrete from the mixers to the walls. When a section within the reach of the booms was completed, including the moving of forms, the derricks were moved forward. After completion of the concreting all forms were utilized as roof sheathing.

Concreting was carried on in vertical sections between adjoining columns by placing temporary boards along the web of one of the columns.

Horizontal construction joints were permitted only along the center line of beams and vertical ones along the center line of columns.

Concreting was permitted whenever the temperature was above $+15^{\circ}$ F., but the materials were heated to prevent "front lumps" when the temperature was below $+40^{\circ}$ F. All fresh concrete (less than 12 hours' old) was protected from freezing.

The packing houses are built of a light steel framed construction on concrete foundation walls. They have roofs similar to the Stock House, but the walls are formed of "Trussit Metal" clipped to the steel girts and plastered with cement.

The principal quantities involved, exclusive of Packing Houses, are:

Concrete (not including floors), 3,570 cu. yds.

Fabricated steel (not including roof), 510 tons.

Steel rods, 103 tons.

Work on the footings was started Sept. 2nd, and the concreting of walls was completed Nov. 28th, 1907.

All steel was inspected at the Mills, and each car load of cement at the job was sampled and tested in accordance with the specifications of the Can. Soc. C. E.

All work was carried out by W. S. Barstow & Company, Engineers, New York, and the stock house and various other buildings of the plant were designed by the writer, who is one of the engineers of that company.

A permanent down town association in San Francisco has been organized for the purpose of compelling the landlords to construct permanent sidewalks in front of downtown property, and to clean the down-town streets, which are still full of debris due to the earthquake and the present building operations.

REINFORCED CONCRETE FROM THE CONTRACTOR'S STAND-POINT.

A Paper read before the National Cement Users' Association by Mr. H. H. Fox, of the Turner Construction Co., New York.

The general problem before the contractor in reinforced concrete is to make the best possible reinforced concrete at the least possible cost. The first part of this discussion will deal with methods to be followed and precautions to be observed in order to attain excellence of workmanship; the second part, with methods to be followed in order to attain this excellence cheaply.

To make the best possible reinforced concrete it is necessary:

1. That the forms should be strongly built, smoothly finished, and as nearly as possible watertight; and should be left in place until the concrete is self-supporting.

2. That the reinforcement should be designed to relieve the concrete of all stresses which concrete cannot safely withstand, and to be amply protected from fire and weather by concrete on all sides; that the reinforcement should be so securely fixed in place before concreting that the concreting will not disturb it.

3. That the concrete should be mixed and placed in such a way that the final product will be homogeneous and without voids.

First.—Forms should be built of matched and dressed lumber and should be greased to make them part easily from the concrete. Their construction will be described in some detail in the second part of this paper. The length of time which should be allowed to elapse before removing forms depends upon two factors, the weather and the load to which the member in question will be subjected upon removal of the forms. The fact that the concrete sets more rapidly the warmer the weather needs no elaboration. It is, however, never out of place to utter a warning against taking risks with concrete in cold weather. I suggest that very valuable information might be obtained from compressive tests on a series of concrete blocks. No. 1 being kept at a temperature of 30 degrees for one month after making, and being tested; No. 2 at 35 degrees; No. 3 at 40 degrees, etc. Scratching concrete with a knife gives one a rough idea of its strength, providing one scratches often enough to become thoroughly familiar with the behavior of concrete under the knife. With regard to the second factor influencing the time which should elapse before re-

moving forms, it may be said in general that the nearer the load to be sustained approaches the load for which the member was designed, the longer the forms must remain. Thus, the forms for an over-hanging cornice should remain in place longer than the forms for almost any other member, because the dead weight of the cornice is a very large percentage of the total weight which it is designed to carry. By similar reasoning, roof forms should remain longer than floor forms; floor forms longer than column forms; column forms in the top story of a building longer than column forms in a lower story; and column forms in general longer than footing forms.

It is very important that forms should be so designed that the column forms may be removed without in any way disturbing the supports of the beams and girders bearing on these columns. In this way a defect in a column may be detected and remedied before any load is brought to bear upon the column. In removing beam and girder forms, the posts should be removed from only one beam or girder at a time, and as soon as the form for this beam or girder is removed, the posts should be immediately replaced. By this procedure, danger of failure of concrete through poor workmanship is much diminished, as a defective member is supported by the members on either side of it until the defect may be remedied. The practice of removing all the posts under a floor at the end of a given period—one, two, or three weeks—without pausing to remove the forms one at a time, examine the workmanship, and replace the posts, cannot be too strongly condemned; both because of the possibility of defective workmanship, and because the concrete floor, even if not defective, may not be strong enough to carry in addition to its own weight, the weight of the one or two floors which may, by the time the forms are removed, have been constructed above it.

There is less danger in taking down column forms when the concrete is thirty-six hours old, and floor forms when the concrete is five days old, if the posts of each member are removed separately, and as soon as possible replaced, than there is in knocking out all the posts under a large piece of floor in three weeks. Legislators who frame laws aiming at safety in concrete construction should bear this in mind.

It is of first importance that the foreman in charge of removing forms should be of a high order of intelligence, and a man who can be relied upon to obey orders literally.

for the reason that a mistake on his part is more likely to cause damage to life and property than a mistake on the part of any other foreman.

Second.—Reinforcement should be designed to take all tensile stresses which occur in a reinforced concrete structure. Whether the reinforcement shall carry shearing or compressive stresses depends upon the conditions in each particular case.

Tensile stresses occur horizontally in the bottom of beams, and, in the case of continuous beams, in the top of the beams over their supports. They occur diagonally in every part of a beam except the top and bottom. The horizontal tensile stresses are taken by horizontal bars. The diagonal tensile stresses are best taken—as most authorities are now agreed—by diagonal bars. As the horizontal tension is less at the end of a beam than in the center, it is obvious that if there are two or more bars in a beam, one of the bars which takes the horizontal stress at the middle of the beam may be deflected to take the diagonal tension near the ends of the beam, and in the case of continuous beams, the horizontal tension over the supports. Thus are developed the familiar bent bars now in common use.

Shearing stresses occur chiefly near the supports of beams. The diagonal tension bars, and partly vertical shear is generally taken partly by the concrete and partly by the tension bars which run over the support. Horizontal shear is taken partly by the concrete, partly by stirrups.

Compressive stresses occur chiefly in the tops of beams and in columns. Comparison in beams is almost always taken by the concrete alone. Compression in columns is taken partly by the concrete, partly by vertical steel bars. Vertical compression in columns induces a horizontal tension or bursting stress. Concrete is so weak in tension that a concrete column without reinforcement usually fails in tension, either by bursting or by buckling. The tendency to buckle is best resisted by vertical steel bars; the tendency to burst, by steel hoops or a steel spiral near the surface of the column.

One method of holding steel in place in a typical beam containing three tension bars is by stirrups that touch the forms only at two points and are, therefore, well protected against fire. The stirrup should not be relied upon to support the tension bars in place, but hang-

ers should be used. As these hangers are of no further value after the concrete is in place, the fact that they are supported directly on the forms, and are thus not fire-proofed, is of no importance. The middle portion of the tension bars in beams and girders is thus held in place by the hangers; the ends are held in place by being laced with wire to one another and to the vertical reinforcement in the columns. The bars in the floor slab are supported off the forms as follows: In order to obtain continuous action over beams every alternate tension bar in the floor slab is sprung up where it crosses a beam, being supported at the edge of each beam by a short piece of band iron about 1-2 in. narrower than the thickness of the floor slab, and bent to an angle of about 60 deg., so that it will stand on edge by itself. In the middle of each span a bar runs at right angles to the tension bars, on top of the tension bars, and is held at any desired distance above the floor by staples into the floor cover and by the lifting tendency of the tension bars which are sprung up over the beams. The other tension bars are then raised from the floor by lacing them with wire to this central bar.

To insure fireproofing in columns, four sticks are used in tamping the concrete columns, and these sticks are run down one on each side of the column between the hoop or spiral reinforcement and the form, thus insuring an amount of fireproofing equal to the thickness of the stick. The vertical reinforcement is placed inside the hoop or spiral reinforcement.

Commercial methods of bending steel to the shapes above mentioned will be considered in the second half of this paper.

Third.—How to mix concrete well, by hand or machine, needs no discussion. How to place it well is another matter. In the case of floors the trick is simple. Concrete should not, unless it is absolutely necessary, be dumped from a wheelbarrow directly in place. The mortar, flowing more freely than the stone, keeps always ahead of the mass, and stone falling in this mortar find a perfect bed; whereas if a barrowful of concrete is dumped into a dry beam the stone may become jammed between the forms and the steel and form a pocket into which the mortar will not enter.

A few years ago I visited a very large concrete job on which the old-fashioned specifications were in force—that concrete must be placed in thin layers. Nobody on the job

seemed to know the trick of placing concrete properly; and consequently the contractor, in order to obtain smooth workmanship, was placing an inch or two of clear mortar in the bottom of all beams and girders, before filling them with concrete. The expense entailed by this may be imagined.

The place to dump the first barrowful of concrete when starting a piece of floor is either on the floor slab or in a column. As long as the mass is kept moving it will be homogeneous, but if it is allowed to set in a diagonal shape two evil results will follow: First, the cement and water, the most fluid part of the mass, will flow forward, leaving behind a layer consisting chiefly of sand, with which the concrete, subsequently placed, will not mix, and which has very little value as fire-proofing; second, the scum which rises to the surface of wet concrete, containing as it does the finest dust present in the sand and stone, sets with a very smooth, glassy surface to which fresh concrete will not adhere. This joint, therefore, if work is stopped on it long enough to allow the scum to harden, will be very weak in shear and tension.

In concreting columns it is necessary to proceed slowly at the bottom of the column and to tamp the first foot with great care. After the mortar flushes to the surface over the entire section of the column, there is little danger of voids being left in the part of the column above the first foot if a sufficiently wet mixture is used. Walls should be similarly handled.

Economy in handling materials.—The exterior column is usually made square for architectural reasons. The interior column is octagonal, partly for architectural reasons, partly to save concrete. This saving is due to the fact that in a column re-inforced with a spiral, the concrete outside the spiral is not figured as adding compressive strength to the column, and, therefore, if this column is square, the concrete in its four corners is wasted. Of course, the question arises whether the concrete saved pays for the additional carpenter work. As a rule, the two items almost counter-balance each other, so that the matter of appearance is more important than the matter of economy.

Two opposite sides of the column are held together by bolts; the other two opposite sides, by hardwood wedges between the bolts and the forms as close as possible to the end of the bolts. In some cases, the sides are made up of narrow strips, to facilitate the reduction in size of the

columns from floor to floor. In warm weather there is no need of having more column forms than one complete set for one story, even when work is progressing at the rate of a story in five or six days. In a ten-story building each column form is then used ten times, once in each story. Each of these narrow strips represents the reduction in diameter of the column from one story to the next. It is, of course, much cheaper to have these strips ripped beforehand in the mill than to have a carpenter rip off a strip for each successive story. The outside and inside of the exterior column form are not made up of narrow strips for the reason that exterior columns are usually the same width from basement to roof. To reduce the section of an exterior column only the thickness is reduced.

In beam work the "girder bottom" is supported on the horizontal clamp of the column form, and the beam forms the girder bottom. Thus all the forms of a floor may be erected before any posts are put in. At any time after the beams are in place the posts are put in and wedged up without any lateral bracing whatever. By this method time and labor are saved. If 2-in. lumber is used for beams, the beams must be at least 2 in. shallower than the girders, in order to allow the beam forms to be supported by the girder bottom.

A wedge-shaped piece in the form of a "key" is inserted to facilitate removal of forms. The flat cover or panel which supports the floor slab is better than the box-shaped type, for the reason that any slight errors in line are taken up at the junction between cover and beam side, and a slight variation in this dimension is not conspicuous.

In removing forms, the column forms are first removed. As has been said, the details about the tops of columns forms should be so designed that they may be removed without in any way disturbing the beam and girder forms. Next, the posts are taken from under the girder. The girder bottom then drops, and the posts are immediately replaced. The nails are drawn from the key, which is nailed only to the girder side; the key is knocked out, the posts are taken from under the beam, the so-called "spreaders" are knocked from under the cover, and the beam form comes down in one piece. The girder sides, which are beveled at the ends, come out easily as does also the cover, which is beveled on all four edges.

A circular saw will effect economy in a building of moderate size,

especially if the same engine or motor may be used to run the saw and other machines, such as a boring machine, a steel hoist, a grindstone, or a shear.

In warm weather, with a complete set of forms for one story, a speed of construction of one story in eight or nine working days may be attained. With one complete set of column forms and a set and a half of floor forms, a speed of a story a week may be attained. The size of the building in plan makes very little difference.

In the discussion of methods of handling steel, the first question is, to what extent shall machinery be used in bending bars? At the present day there is, so far as I know, no machine which bends tension bars for beams and girders as economically as they can be bent by hand. For one thing, the cost of handling the bars to and from the place of bending is a very large percentage of the cost of bending, and this cost would remain the same in either case. The decisive reason is, however, that the variety of possible shapes of bent bars is infinite; the number of different shapes required in one building is very large, and a machine, to be efficient, would have to be capable of rapid adjustment from one shape to another, and consequently complicated.

A machine can be made to bend stirrups and hangers economically, as they are light and of smaller variety than tension bars.

In making spirals two processes are involved. First, bending the steel, which is usually in the form of wire, to the required diameter; second, spacing the coils to the required pitch, and fastening them so rigidly to longitudinal bars that this pitch will not be disturbed in handling. The first process is accomplished more economically by machine, the second usually by hand.

A simple cast-iron block may be used for bending beam and girder bars. The block is attached rigidly in a horizontal position to a bench. The bar is dropped in a slot in the block, a piece of extra heavy pipe is slipped over the end of the bar, and two or three men bend it to the required angle. This bending block may be made of an iron plate with two angles riveted to it back to back to form the slot. Stirrups when bent by hand are bent on such a plate, the angles, of course, being small and only far enough apart to admit a bar of the size used for stirrups. A plate for bending stirrups may be made small enough to slip in the pocket.

Spirals are made up on a simple

wooden reel, the requisite of this reel being that it should be rigid, adjustable for different diameters, and collapsible to allow the finished spiral to be easily slipped off.

The question whether power other than hand power should be used to hoist the reinforcement to the floor where it is to be used depends upon the height of the building, the quantity of steel on each floor, the rate of progress, and the prevailing rate of engineers' wages. In New York City the wages of engineers for one day will pay for a good deal of hoisting by hand; and it may be roughly stated that when the rate of hoisting is less than one foot-ton per minute, nothing is gained by installing special machinery for hoisting steel. It is of course necessary to have steel on a floor before concreting; therefore, the necessity of having a derrick light enough to be attached to the forms before they are filled is apparent. The strain of the fall-rope on the derrick pulls the column to which it is attached out of plumb less than an inch, and this displacement is easily recovered with a guy-rope and turn-buckle before concreting.

The question whether or not a charging hopper shall be used depends on several things. Unless it is possible to set the mixer several feet lower than the storage of sand and stone, some kind of hoist must be arranged to fill the hopper. This means additional machinery and generally the wages of an additional engineer. In New York City one of the obstacles to setting a mixer much lower than the storage piles is tidewater. Basement floors in New York are often laid as near tide level as possible; during the construction of a building the basement is used for storage of sand and stone and in order to set the mixer much lower than the basement floor an expensive waterproof pit must be constructed. A charging hopper, of course, makes it possible to charge the mixer more rapidly; but the fact should be borne in mind that no time is saved by charging the mixer more rapidly than the concrete can be taken away, up on the floor. The mixer should be set so low that the wheelbarrows run on a level or slightly down-grade in feeding the mixer.

In many cases the mixer is driven from the shaft of the hoist, and this shaft, from the motor.

The question how large a mixer to install depends upon the rate at which concrete is to be used. Without a charging hopper, an ordinary mixing plant will turn out easily forty batches per hour, and may be

made to turn out sixty batches if the hoist is designed to take it away as fast as that. In laying out a schedule for concreting, attention should be given to the fact that speed makes for economy, for the reason that there are several special men in a concrete gang whose wages remain the same regardless of the amount of concrete placed. There are an engineer, a foreman, and at least three laborers, viz., one throwing water into the mixer, one dumping the mixer and one loading the wheelbarrows up on the floor. The sum of their wages at New York rates is \$16.60 per day. If 80 cu. yd. are mixed in a day these men add to the cost of mixing about 20 cents per yard; if 160 cu. yd. are mixed they add only 10 cents per yard.

With regard to plant in general it may be said that many contractors make the mistake of installing more machinery than is warranted by the quantity of material to be handled by this machinery. For example, on a piece of concrete work containing about 1,500 cu. yd. of concrete, which I once visited, \$10,000 had been spent on plant before a yard of concrete was mixed. At least \$6,000 of that was wasted; for, although the unit costs may have been made less than they would have been if more primitive methods had been employed, the total costs, including the cost of installation, were much greater. The machinery did not have enough to do to pay for itself. To determine correctly the kind and quantity of machinery to use, a contractor must have good judgment and a thorough knowledge of costs.

THE EFFECT OF CEMENT ON REFRACTORY LININGS.

Some particularly interesting experiments have recently been made by Dr. Loeser, of Halle, with a view to ascertaining the best material for lining cement kilns and enabling them to resist the corrosive action of the cement clinker.

The first experiments were made with a kaolin of great purity and of a composition corresponding to the best samples of china-clay, in which all the silica was combined with the alumina so as to give a material which, theoretically, was perfect in refractory power. The result of using this material was most disappointing, and even when the quantity of alumina in the mixture was increased to 45 per cent. on the fired clay (the highest proportion of alumina which can theoretically combine with the silica) the results were no better. Consequently it

would appear that a high alumina content is not, in itself, sufficient to produce a refractory material which can successfully resist the action of hot cement clinker.

When the refractory material was coated with a thin covering of an artificially prepared alumina ("Diamantin") completely satisfactory results were obtained, and a prolonged heating (extending over many hours) of the cement in contact with this diamantin proved to have no effect upon it whilst the unprotected portions of the kiln lining were completely eaten through.

It therefore appears probable that a comparatively small proportion of silica in the refractory lining of cement furnaces is a serious disadvantage to the life of the latter, and that cement manufacturers would find it more economical to use a thin lining of diamantin or other fairly pure alumina as a protection to the ordinary refractory clay blocks now used.

Dr. Loeser is continuing his experiments in order to ascertain what proportions of clay and alumina can be used in order to obtain a satisfactory material with great heat and corrosion resistances at a reasonable price, artificially prepared alumina being somewhat too costly for general use.

The particular form of alumina he used is not at all well known in England, but it appears to be highly probable that carborundum, which is being imported in large quantities from the United States, or even blocks or thin slabs made of bauxite, would be equally satisfactory, though at the present moment we have no detailed information on this matter.—British Clay Worker.

RESPECT FOR THE DEAD.

The strangest coffin of which there is record, perhaps, is one for which the British war department is responsible. The story is that a workman engaged in casting metal for the manufacture of ordnance in the Woolwich arsenal, lost his balance and fell into a caldron containing twelve tons of molten metal. The metal was at white heat, and the man's body was utterly consumed in less time than it takes to tell about it. The war department authorities held a conference and decided not to profane the dead by using the metal in the manufacture of ordnance, and the mass of metal was actually buried, and a Church of England clergyman read the services for the dead over it.

THE MUSHROOM SYSTEM OF REINFORCED CONCRETE CONSTRUCTION.

C. A. P. Turner, C. E., of Minneapolis, Minn., is the inventor of this system. It consists of forming a single slab of uniform thickness covering the entire floor area of the building, supported by the four walls and columns, there being no beams or girders, producing a smooth, flat, level ceiling from wall to wall, reinforced as shown in Fig.

ceiling and columns are shown in Fig. 3.

The slab rods are strung through the mushroom frames at the head of each column and sag between the columns to bring them near the bottom of the slab, all bars being wired together at their intersections. Provision is made for shrinkage and other stresses. A larger section of metal is placed in the upper part of the slab, surrounding the column head, to resist the greater

the transmission of sound. From the nature of its reinforcement this system is particularly well fitted to be used in the construction of warehouse or similar buildings, where, due to the presence of aisles or passageways for trucks between the columns, the load is concentrated around the columns, just where the mushrooms with their heavy reinforcement are placed; and it is a rather encouraging fact that the heavier the loads to be carried the



Fig. 1.—Mushroom System of Reinforced Concrete, False Work and Reinforcing bars in place ready for the Concrete, in the Evanston Fireproof Warehouse, Evanston, Ill.

1, which in this instance shows the roof construction. The reinforcing for columns is shown in Fig. 2, with the false work in place, upon which the floor slab is to be formed. The column forms are of iron, enlarged at the top. The perpendicular column bars at the top are bent over at right angles and wired to two or more concentric rings or hoops, over which a net work of bars are placed; these bars cross at right angles as well as diagonally, terminating in the four walls, all as shown in Fig. 1. The finished floor,

bending stresses existing there. The compression which is greatest over the columns is taken care of by increasing the diameter of the column at the top, forming a capital for the column which gives an ornamental finish.

The flat ceiling obtained gives free and unobstructed illumination from the windows; it permits one to place partitions anywhere without regard to the floor; and it gives a great stiffness and solidity, due to the extraordinary thickness of the slab, with consequent reduction in

more economical this form of construction becomes as compared with the usual beam-and-slab method. The mushroom system does not require expensive forms for girders and joists, with attending waste of lumber, but simply a smooth slab support, requiring very little to construct and to remove. The concreting can also proceed rapidly, due to the uniform slab thickness and the reinforcement of plain steel rods, of which very few are bent, and no stirrups are needed.

Several large buildings have been

erected under this system by the Alling Construction Co., of Chicago. In one building the columns are twenty-six feet apart in each direction. There are over 4,000,000 square feet of this construction in use.

TEXAS CEMENT COMPANY CHARTERED.

The Texas Portland Cement Co., of Dallas, Texas, with an authorized capital of \$3,000,000, of which \$30,000 has been subscribed and paid in, has been chartered under the laws of West Virginia.

The incorporators are: Otto Kaiser, J. G. Mathews, E. J. Mudd, John M. Gamble and Harry R. Hattman, all of St. Louis, Mo.

The Building Law Committee of the San Francisco Council has submitted a new ordinance for reinforced concrete dwelling house floors which provides for a thickness of $1\frac{1}{2}$ inches instead of three inches under existing ordinances. This is O. K., provided sufficient metal is used in the floor. The malt house floors in large Milwaukee breweries constructed by E. S. Ransome ten years ago were only 2 inches thick, which was regarded as perfectly safe and proper.



Fig. 2. Column Reinforcement.



Fig. 3. Columns and Floor Slabs.

EDISON'S CAST HOUSE.

There appeared recently in your publication an article concerning the "Edison Molded Concrete House," stating that a 2 story structure can be erected for a little over \$1000.00 that it can be cast in 12 hours (after mold is in place) that the mold can be removed in 6 days, that in another 6 days it will be ready for occupancy, that at the same time all interior and exterior ornaments as well as the bath tub, mantels, stairs and partitions will be cast, etc., etc.

Nobody would welcome such an invention more than the writer—but being an expert in the artificial stone line, and especially in concrete with an experience covering a period over 20 years, I state most emphatically, that it will be impossible to accomplish this.

I can not go into all details here, but will mention a few reasons, in support of my statements and warn the public not to be too hasty in accepting Mr. Edison's claims.

It is surprising that not more dissenting voices have been heard. Are there so few real experts in this line of business or do they fear to come forth to dispute the opinion of so great a man as Mr. Edison? To fill such a "House Mold" it will be necessary to have a very thin mixture of concrete, so thin that it will flow freely. Thus, it will be seen, that, the aggregates will settle at the bottom, and the water, taking with it the fine parts of the cement, will come to the top and also ooze out of all joints (because no iron mold, composed of so many parts is absolutely watertight.) The scum which always forms, will of course go to the top, into ornaments and especially undercuts. The walls of the mold will neither absorb moisture nor air, therefore little air bubbles will form all over the smooth iron mold. Two aggregates will obstruct many places, and large and small holes are the result. A great deal of mending and patching would have to be done, which may cost as much or more than the first cost of the building. Besides this, such a patched up house will not look good, even when done by experts.

Next, it is impossible that this house will dry out in 6 days, nor even in 30, and if the concrete is not kept damp for a considerable time, say 50 to 60 days, the final setting will not take place properly, shrinkage and air cracks resulting.

In my opinion it will take at least three months, after curing, before this house would be dry enough for occupancy.

How about floors, doors and win-

dows? None of them can be put in place before the concrete is dry, otherwise they will warp, especially the floors, to such an extent that they will have to be replaced.

Much more could be said in contradiction, but time and space forbids it.

—Hans Hirsch,

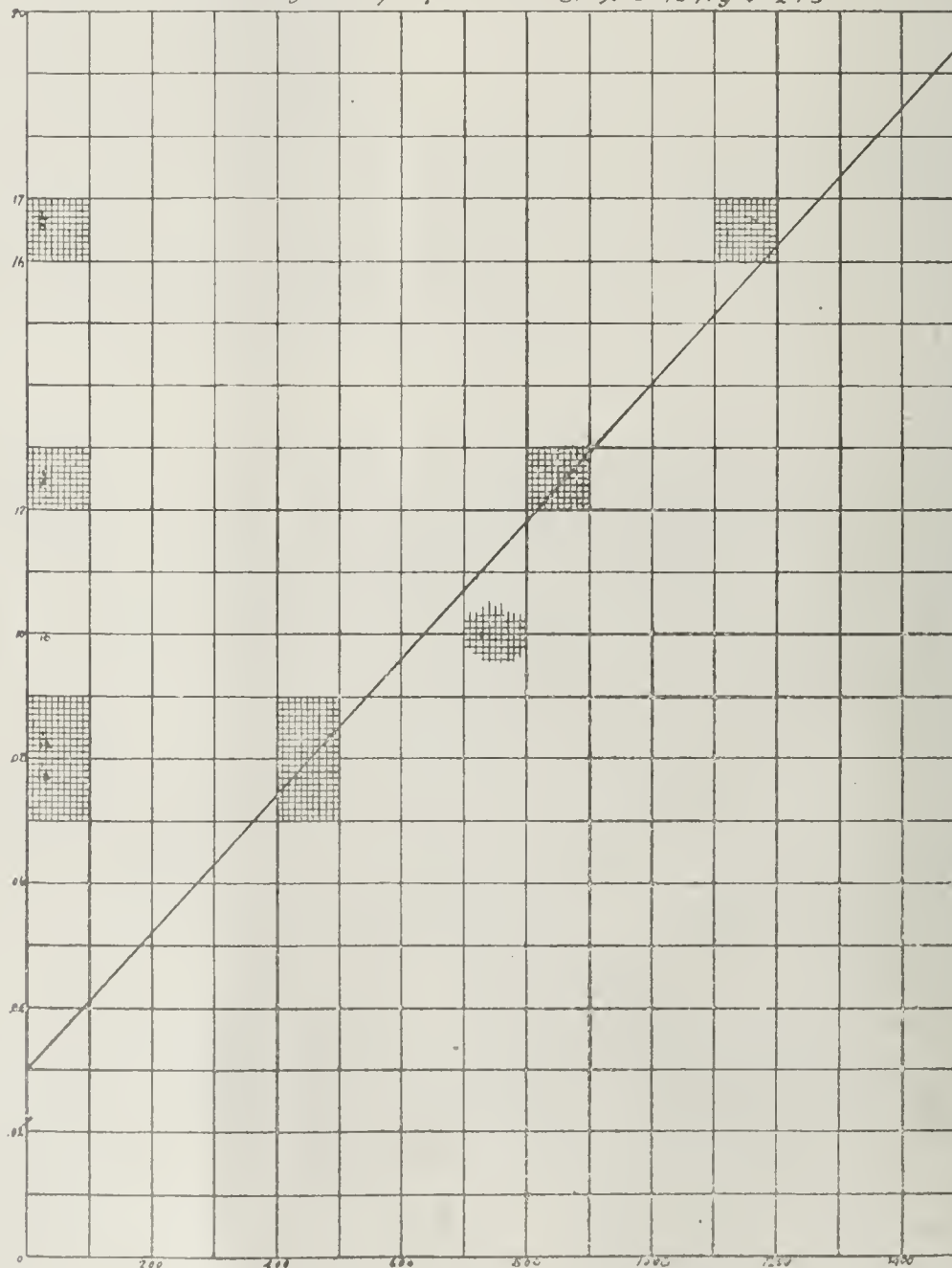
President Orleans Tile Mfg. Co.
New Orleans, La., 1634 Washington Ave.

RELATIONS BETWEEN AMOUNT OF CEMENT AND STRENGTH OF CONCRETE.

In a recent paper on "Proportions Used and Methods of Mixing Concrete," Mr. Leonard C. Wason, president of the Aberthaw Construc-

tion Co., Boston, Mass., presents from actual tests some interesting facts regarding the effect of the amount of cement upon the strength of concrete. His statement is as follows:

Diagram showing the relation between amount of cement used and the strength of the concrete



tion Co., Boston, Mass., presents from actual tests some interesting facts regarding the effect of the amount of cement upon the strength of concrete. His statement is as follows:

"The necessity of thorough mixing has been universally known for many years. The loss of strength

was dumped from the mixer a cone was allowed to form, down the sides of which a quantity of stone rolled, separating from the mortar and accumulating around the base of the cone. A second batch was made, the cement and sand being thoroughly dry mixed before adding the stone, and then thoroughly

mixed together when in the mixer. No cone was allowed to form. A third batch was mixed by hand, being turned five times, the engineer, with a hoe, throwing into the mass stones which became accidentally separated from it. In filling the moulds the engineer insisted that from the first batch stone be shoveled up from around the base of the cone. The rest of the batch which remained properly mixed, was filled into other moulds, four cubes and two beams being made from each batch. The first cube averaged only 2 1-3 lbs., or about 2 per cent lighter than the other three cubes, due to lack of mortar. Nevertheless it gave a result 28 per cent below that of the average of the other three, the figures being 3081 lbs. per square inch as against 4263 lbs. per square inch, the average of the other three. Age of all specimens was 90 days. The average of the four cubes which were dry mixed before mixing in the machine was 4123 lbs. The hand mixed specimens averaged 3187 lbs. It will be seen that there is an advantage in machine mixed concrete over that made by hand of 25 per cent, and that that which was not dry mixed before putting into the machine gave 3 1-3 greater strength than that which was. The machine used in this case was the Portable Gravity Concrete Mixer. It is safe to assume that these specimens were more carefully made than under ordinary commercial conditions, which they tried to reproduce, and the marked weakness of the specimens which lacked but a small amount of mortar is very significant. The weakness is doubtless due to the voids in the material reducing the cross sectional area. Ten years ago another series of experiments was conducted by the writer at the Watertown Arsenal, giving the relative merits of machine and hand mixed concrete and the strength of various mixtures. These were specimens one foot square and varying from six to fourteen feet in length. They were all made in mid-winter in an open lumber shed and remained in the open air until tested, which accounts for the low ultimate strength. The modulus of elasticity of the hand mixed specimens with proportions of 1:3:6 and average age of forty-three days at a stress of 700 lbs. per square inch was 2,500,000, the machine mixed, 2,870,000, an increase of 12½ per cent of the modulus. The ultimate strength of the hand mixed was 921 lbs., the machine mixed, 1,111 lbs., an increase in the ultimate strength of 17 per cent, due to machine mixing. The hand mixed specimens in

this case were somewhat better than commercial conditions because in order to fill the moulds the concrete was handled several times more than would be necessary in placing ordinary work. Each handling was equivalent to a mixing. It will be seen, therefore, that there is a marked improvement in strength, due to machine mixing, and as the machine is positive we can be assured of obtaining this concrete uniform, whereas with hand work it is likely to be anything but uniform, while a little carelessness makes a big difference in the final strength.

A series of specimens were made one foot square, six feet long, machine mixed, identical in every way except the amount of cement used. There were two specimens each 1:3:6, 1:4:8, 1:5:10, 1:6:12, 1:7:13. The results of each pair were averaged and are shown in the accompanying diagram. While these tests are not extensive enough to be conclusive they indicate that the strength is directly proportional to the amount of cement used. Be careful to note the difference between the ratio of parts of cement to parts of stone and the ratio of volume of cement to volume of concrete."

GALALITH.

The new composition called "Galalith," is said to possess the characteristics of vulcanized India rubber and celluloid, excepting that it is odorless and not inflammable. The article is manufactured from skimmed milk, freed from water, which undergoes a process of vulcanization, after which the plastic material is placed under heavy pressure for the purpose of securing desired forms. From 60 quarts of skimmed milk about 18 ounces of "Galalith" are produced. The pure article is transparent and can be colored with the aid of an acid, the nature of which I have been unable to procure, in imitation of ivory, tortoise shell, vulcanized rubber, amber, marble, coral, etc. The composition in a thoroughly warmed state (by an immersion into water of 212 degrees Fahrenheit) can be formed and will retain its shape. It is further claimed that "Galalith" can be worked the same as natural horn in the way of sawing, cutting, polishing, etc., and that it is not affected by coming in contact with oils, grease, ether, benzine, etc. "Galalith" sells at 45 to 60 cents per pound.—Kulhow's German Trade Review.

The Speeds Portland Cement Co. at Speeds, Indiana, has been installing new machinery.

CYCLOPEDIA OF ARCHITECTURE, CARPENTRY AND BUILDING.

A general reference work covering the field of the building industry and its allied arts and trades. Prepared by a staff of practical experts of the highest professional standing. Ten volumes. Illustrated with over 3,000 engravings and about 400 special plates. Red half-Morocco, gilt stamped, marbled edges. Indexed. List of plates. Published by the American School of Correspondence, Chicago, Ill. List price, \$60.00. Introductory price, \$19.80. They are sent free on trial.

This is truly a great work, both in conception and in execution. We have not seen during the past decade a reference work whose appearance is more timely—which is more comprehensive or practical—or for which a positive necessity has been more distinctly created by the progress of events. The rapid advances made in recent years in the engineering and mechanical fields and in the evolution of constructive processes and methods, have affected the building industry more than any other. They have practically revolutionized it and have radically changed the conditions and requirements of all its allied arts and trades.

The publishers have taken time by the forelock in giving to the world for the first time a really comprehensive and authoritative work summing up the results of modern progress in this field. The task was a difficult one, but has been most admirably done. This cyclopedia is a practical working guide to modern methods of building construction in all its details, embodying the most approved practice. It will therefore be extremely valuable to cement and concrete contractors, and all others interested in construction work of any kind, and also to prospective builders. It ranges from the masonry wall or steel frame to the carpentry and interior decoration, from the plumbing and draining to the heating and ventilation, from the foundation to the roof and cornice, from the drawing of the plans to the awarding of the contract and the acceptance of the completed structure.

The volumes are especially adapted for purposes of self-instruction and home study. The language is clear and simple, and the arrangement of matter such as to take the reader along by easy steps. Every section has been specially prepared for practical use by men of acknowledged professional standing, as is shown by a glance at the list of writers in the front of each volume, and at the list of architects whose work is reproduced. The books are compiled from the regular instruc-

tion papers in the architectural course of the American School of Correspondence, to fully demonstrate the thorough character of the instruction given. As an educational power, it is doubtful if the value of this quiet but forceful work is generally appreciated. Its influence is to instill a knowledge of the principles that are fundamental to all good design, and an appreciation of what is good and simple and straightforward in architecture, thus tending to prevent the awful monstrosities that are sometimes committed in the name of architecture.

The Indiana Railroad Commission has reduced the rate on coal from the mines at Linton to the U. S. Portland Cement Co.'s plant from 75c. to 50c. per ton, this being a joint rate of the B. & O. S. W. and the Southern Indiana railway. The railway companies still charged the old 75 cent rate until the cement company obtained an injunction against the old 75 cent rate. Now the railways compel payment of freight on coal as soon as consigned instead of two weeks after consignment, as was the rule under the 75 cent rate. The two roads have not been able to come to an agreement on the division of the revenue from the 50 cent rate now in force.

The Great Western Portland Cement Co. has placed an order with the Lehigh Car, Wheel & Axle Works, of Catasauqua, Pa., for Fuller-Lehigh Pulverizer Mills for both the raw material and clinker departments of their two thousand barrel cement plant being erected at Mildred, Kans. The Great Western Company is making rapid progress in the building of their plant and expects to place its brand on the market this summer.

The Hawkeye Portland Cement Co. has placed an order with the Lehigh Car, Wheel & Axle Works for Fuller-Lehigh Pulverizer Mills for their two thousand barrel cement plant being erected at Harvey, Iowa. These mills will be used in coal, raw material and clinker departments.

The officers of the Egyptian Portland Cement Co., chosen on January 22, at Fenton, Michigan: President, C. Tinker; vice-president, W. H. Edwards; E. D. Kennedy, secretary and treasurer; J. F. Williams, general manager; Clarence Tinker, Fenton; H. W. Edwards, Flint; J. F. Williams, Detroit; C. D. Sanderson, Scranton, Pa.; D. S. Frackelton, Fenton; E. M. Hughes, West

Pittston, Pa.; A. W. Maynes, Detroit; E. D. Kennedy, Fenton. The only change in the list of officers for the company was that of general manager, C. L. Bussey, the outgoing manager, who has held the position for the past two years, retires of his own accord.

William H. Weitknecht, assistant superintendent of the Atlas Portland Cement Company, Hannibal, Mo., has tendered his resignation, and in a few days will depart for Mitchell, Ind., where he takes the position of superintendent of the two big plants of the Lehigh Valley Cement Company plant at Mitchell, Ind. Mr. Weitknecht was formerly employed by the Lehigh Company.

The Western Portland Cement Co. shut down on January 17th on account of the slack demand for cement principally from railway companies. The plant expects to resume in April.

A consolidation of the Kansas Portland Cement Co. of Iola, Kans., of the Independence Portland Cement Co. of Independence, Kans., and the Indian Portland Cement Co. of Neodesha, Kans., has been effected under the name of the United Kansas Portland Cement Co., with general offices at Iola. The following are the officers of the consolidated company: President, Geo. Nicholson; vice-president, A. B. Cockerill; treasurer, L. L. Northrup; attorneys, A. H. Campbell and John F. Goshorn.

CEMENT MEETING.

The annual meeting of the Commercial Cement Company, Limited, was held at Grand Forks, N. Dak., and the following officers elected: President, W. P. Alsip, Winnipeg; vice-president, Sidney Clark, Grand Forks; secretary-treasurer, Otto Babcock, Grand Forks. The plant of the company is located in Manitoba, about 70 miles from Winnipeg.

Denver papers state that negotiations are under way to bring about a combination of cement plants in Colorado, Utah, Montana and North Western Texas, as well as the purchase of a plant in the Kansas gas belt. The combine expects to have a capital of \$8,000,000. The headquarters of the combine is to be in Denver.

A fire at the Bay Bridge plant of the Sandusky Portland Cement Co. on January 29th, caused a loss of \$20,000. The plant was to start

up February 15th. A month or six weeks will be required to repair the damage done by the fire before the plant can resume.

The Standard Portland Cement Co. of Napa Junction, Cal., which was compelled to shut down several months ago on account of car shortage, has resumed operations.

The Forseglen Land Co., Chas. F. Behrens, manager, 961 Calvert Bldg., Baltimore, Md., is arranging to establish a plant for the manufacture of concrete blocks, etc., Machinery will be purchased and a plant erected for that purpose.

The Illinois Fire-Proofing Company, Grafton, Ill., has been incorporated with a capital stock of \$100,000 by John A. Dailey of Terre Haute, Ind., William H. Jounrye, mayor of Grafton, and others.

Lee Worthington of Hot Springs, Ark., and associates contemplate the development of clay property about eight miles from there.

The West Coast Portland Cement Company, Lewiston, Idaho, has been incorporated with a capital stock of \$5,000. The company will at once begin work on the construction of a cement mill, on Upper Snake River, twenty-five miles southeast of this city.

The Tehachapi Portland Cement Company of Los Angeles, has been incorporated with a capital stock of \$5,000,000.

The Great Western Portland Cement Company has placed an order with the Lehigh Car, Wheel & Axle Works, Catasauqua, Pa., for Fuller-Lehigh pulverizer mills for both the raw material and the clinker department of its 2,000 barrel cement plant being erected at Mildred, Kans. The Great Western company is making rapid progress in the building of its plant and expects to place its brand on the market this summer.

The Hawkeye Portland Cement Co. has placed an order with the Lehigh Car, Wheel & Axle Works for Fuller-Lehigh pulverizer mills for its 2,000 barrel cement plant now being built at Harvey, Ia. These mills will be used in coal, raw material and clinker departments.

The "shaking system" of settling is used by the D. & A. Post Mold Co., Maple street, Three Rivers, Mich., in connection with its method of manufacturing concrete posts. This company makes the D. & A. steel post molds, with a device for placing reinforcing. This consists of either a six or a ten-mold outfit and contains no hinges or joints. Among advantages claimed for this system are the following: Most rapid method for filling molds and placing reinforcing; easiest method of removing post; simple in construction, with no pallets or planks. The price of this outfit is low. The D. & A. Post Mold Co. was represented at the recent Buffalo cement show and its system for making posts attracted a great deal of attention. Concrete workers should write this company for further particulars.

Capacity of the plant of the Virginia Portland Cement Co. at Craigsville, Augusta Co., Va., is being doubled. About \$2,000,000 will be spent in improvements, a trust mortgage for that amount having been filed by the company at Staunton, Va.

The Rocky Mountain Cement Co. has placed an order with the Lehigh Car, Wheel & Axle Works, Catasauqua, Penna., for Fuller-Lehigh Pulverizer Mills for grinding coal, rock and clinker in their new plant at Calgary, Alberta, Canada.

BUILDING A BIG CEMENT PLANT.

Active work is in progress on the plant of the largest cement manufactory in California, that of the Cowell Portland Cement Co., organized over a year ago, with a capital of \$2,000,000. Officers of the company are: President, E. V. Cowell; vice-president, S. H. Cowell; secretary and general manager, W. H. George.

The plant is located at Cowell, Contra Costa county, about thirty miles east of San Francisco, and it will have a daily capacity of 4,000 barrels when it is completed. The most modern improvements are being installed throughout the mill, and the company will be thoroughly equipped for business when the wheels begin to turn. Raw materials are reported to exist in abundance, and the company has arranged for practically private shipping facilities by building a standard-gauge railway from the plant down to Bay Point, ten miles distant, on San Francisco Bay. Shipments by water to San Francisco

are thus provided, and connections are made at Bay Point with the Santa Fe and the Southern Pacific. The big plant is expected to be producing shortly after the first of the year.

In 1897 the cement imported into Japan was valued at \$413,604 while the export of cement of domestic manufacture has valued at \$8,128. In 1906 the value of cement imported into Japan was \$4,052, and the cement exported was valued at \$290,335.

In the January issue of Cement and Engineering News appeared a cut of the plant of the Oklahoma Portland Cement Company at Ada, Oklahoma. This is what they have to say regarding the Fuller Mills manufactured by the Lehigh Car, Wheel & Axle Works, of Catasauqua, Pa.

"No doubt you will be interested to learn of the results we are securing by the use of your mills on our various materials. Unqualifiedly your mills are the best coal grinding apparatus on the market; we are experiencing absolutely no difficulty with them whatever, and the coal is being pulverized to a very uniform fineness, averaging 93 to 95 per cent on one hundred mesh. On our raw material, all that we can say, is that they are pounding away night and day, giving us most excellent results. Average fineness on a two hundred mesh being 85 per cent. On clinker your mills are giving us 85 per cent on two hundred mesh; this is much finer than any other system of grinding the writer has had experience with. There is no use comparing your mills with any other mills, as you are well aware of the results obtained from the other mills now on the market. In addition, we might add, that the Fuller Mills are entirely satisfactory to us, and we are anxiously awaiting the day when business conditions of the country will become normal, and this means an additional order for Fuller Mills for all departments. This alone shows our confidence in your machinery."

COST OF GRINDING GOLD ORE IN TUBE MILLS.

The extensive use of tube mills for grinding cement makes the following figures of the cost of tube-milling gold ore of general interest. These figures are taken from a paper read before the American Mining Congress at its Denver, Colo., meeting in 1906 by Mr. F. L. Bosqui. We quote as follows:

"The cost of tube milling is vari-

able. In this country and Mexico it will range between 20 and 40 cts. per ton. The practice at El Oro, Mexico, and at Telluride, Colo., is representative of the best practice on this continent, while the figures on tube milling at the Combination mine, Goldfield, Nev., probably represent the maximum of cost, owing to high price of power and labor. A small 4 x 12-ft. trunnion mill is installed at the latter property for sliming the forty-mesh product from a Bryan mill. The product of ten stamps, about 35 tons of ore per day, passes to the tube mill classifier, and of this product about 75 per cent goes to the tube mill, or 24.6 tons per day. The following figures may be of interest:

"Cost of 2 1-2-in. silex lining laid in mill, \$323.50; life of lining, 4 months; cost of lining, 7.7 cts. per ton of ore stamped; cost of pebbles delivered Goldfield, \$71.00 per ton; consumption of pebbles, 2.03 lb. per ton of ore stamped; cost of pebbles, 7.1 cts. per ton of ore stamped; horsepower; 25 h. p. at \$11.25 per h. p. per month; cost of horse power, 26.7 cts. per ton of ore stamped; summary: Cost per ton of ore stamped:

Pebbles	\$0.071
Lining	.077
Power	.267

Total per ton.....\$0.415

"Tending the mill is one of the several duties falling upon one man; and the consumption of lubricants is almost negligible. I have, therefore, not included these two items in the cost. This cost of 41 cts. per ton may be assumed to be the maximum for tube milling, owing to the very high cost of labor and freightage in the southern Nevada camps."

The Alabama Portland Cement Co., Ltd. London, England, works at Demopolis, Ala., executed a mortgage for \$10,000 recorded in England, covering 15,000 barrels of cement in certain bins in stock house and all wagons, carts, etc., at the plant.

The Flint Cement Co. has been incorporated as a N. Y. corporation. Capital, \$500,000. The company owns 700 acres of land at Gorham, Ontario Co., N. Y., on the line of the Lehigh Valley Railway. With extensive marl deposits the company's charter permits it to purchase property and equipment equal to its capitalization. Natural gas fuel is to be used. Principal office, Geneva, N. Y. Mr. Lyman J. Baikin, E. & B. building, Rochester, N. Y., is secretary and counsel.

THE A. MONSTED CO.

Known for years as pioneers of reinforced concrete construction, and having been associated with Ernest L. Ransome, better known as the father of reinforced concrete construction in the United States, the old firm of A. Monsted & Co. has been dissolved and the A. Monsted Co. incorporated, Milwaukee, Wis. Its work in the past has given this firm an enviable reputation for reliable construction.

The entire floor and roof construction of the Boston Store, Milwaukee, which is of concrete, was built by this company in 1896. In 1903 the Johnson Service Co.'s building was built in Milwaukee. In spite of the

was of reinforced concrete. The oil house of the same plant was of similar construction.

Within recent years the firm has done a great amount of brewery work, consisting of encasing steel skeleton construction and reinforced concrete floors. The new stock house of the Jos. Schlitz Brewing Co., Milwaukee, in which 10,000 barrels of cement and twenty tons of steel bars were used, is a good example of this type of construction.

The new company, as heretofore, intends to do all kinds of reinforced concrete construction, as well as composition roofing and asphalt paving. The services of Wm. F.



Concrete Floor and Roof Construction of the Boston Store, Milwaukee. Built by the A. Monsted Co. in 1896.

great vibrations due to the machinery in operation the building stands today a good example of the durability and strength of reinforced concrete construction.

The A. Monsted Company not only does building construction, but the large concrete chimney for the heating plant of the John Plankinton Estate, Milwaukee, was built by them, as were also the tunnels under the Grand avenue and to the Boston Store, a distance of 800 feet. Another tunnel was built for the Pabst Brewing Co.

Neither is the company's work confined to Wisconsin. In 1900 the company built the Singer Mfg. Co.'s veneering plant at Cairo, Ill., comprising one building 114x140 feet, containing 64 tanks, and another 75x252 feet. The rats, footings, columns, beams, girders, floors and walls were all constructed of reinforced concrete.

At South Bend, Ind., the Singer Mfg. Co.'s wood work plant was built. This comprises 24 lumber dry kilns holding 1,500,000 feet of lumber, and two smoke stacks 130 feet high. The entire construction

Tubesing, civil engineer, have been secured. Mr. Tubesing has 100 years been connected with all classes of plain and reinforced concrete work of large magnitude throughout the United States, and he has written extensively on the subject for leading engineering magazines of the country. The company will be glad to give its patrons any information possible bearing on this class of work.

F. L. Smidth & Co., Engineers, 41 Courtland St., N. Y., have issued a handsome Calender for 1908, showing a marine scene, with a life saving crew in rescue work entitled "All in a day's Work."

Over four hundred and fifty million tons of coal were produced in the United States in 1907, being 10 per cent greater than in the previous year, the output of Pennsylvania anthracite was 76,366,000 long tons of which 67,109,393 were shipped. The bituminous output is estimated at from 365,000,000 to 375,000,000 tons for 1907.

THE NEXT WORLDS FAIR.

Seattle, Washington, is making extensive preparations for the Alaska, Yukon, Pacific Exposition, which is to be held at Seattle, Wash., from June 1st to October 15th, 1909. The grounds and building are well under way. No government aid will be asked for to float the enterprise, other than asking the government to make a creditable display at the Exposition.

Messrs. Bryant & King of Pasadena, Cal., have the contract for a water tank 30 feet in diameter and 6 feet high to be built for the Beaumont Sand & Water Co., of Riverside, Cal. They will likewise furnish 5450 feet of 12 inch steel and cement pipe to connect with the present water system.

The Washington Cement Company resumed work at its plant at Concrete, Skagit County, Wash., with a full force of men. Improvements have been made during the close-down and the plant will be operated at full capacity. About 100 men will be employed and the daily output will be about 1,000 barrels of cement. The Great Northern Ry., will run an extra train on the Rockport branch in order to handle the shipments promptly.

Balfour, Guthrie & Co., of Portland, Oregon, have chartered the French bark *Eugenie Fautrel* to bring a cargo of Belgium cement from Antwerp, to Portland, this is the fourth ship the company has chartered to bring cement from Europe. A member of the firm says that the demand for cement will be about as heavy during the coming season as in 1907.

William Taylor, an employee at the Lehigh Portland Cement Company plant at Mitchell, Ind., attempted to open a box of dynamite with an axe, and was blown to atoms, pieces of his body being found several hundred feet away.

A NEW CEMENT PLANT FOR CHINA.

A cement plant is to be erected at Paotzukai in Kwantung territory, Manchuria, by the Onoda Cement Company, of Japan, which has a 450 barrel cement plant at Tokugama, Yamayuchi, in southern Japan and head office at Tokyo. The plant in China will be located 7 miles from Danley, and north-east of Port Arthur, where the company has a concession of 1488 acres of land, carrying suitable lime stone, while the clay will be brought from

Pulantien, 40 miles north. The company propose to invest \$498,000 gold in the enterprise. Work is to begin in March of the present year.

The Flint Cement Company, of Gorham, Ontario County, N. Y., has been incorporated with the Secretary of State, with a capital of \$500,000. The directors include C. K. Benjamin and others, of Geneva. Mr. Benjamin is a contractor rated at from \$500 to \$1,000. Operation of the plant will also tend to greatly improve the passenger traffic between Bellingham and Concrete.

BIG CEMENT COMPANY STRIKES A GAS WELL.

On December 27th, while engaged in drilling, a monster gasser was struck at Chanute, Kans., on the west holdings of the Ash Grove Lime and Portland Cement Company, of Kansas City, Mo. This strike was certainly one that will be appreciated by President Hill, of the company, and the stockholders generally. The new gas well is Spong No. 1 and is a monster, measuring precisely 30,648,280 cubic feet daily. The hole is drilled to a depth of 838 feet, twenty feet of which is in pay sand. For every foot drilled through the producing strata, the flow of gas increased one pound in pressure, a remarkable record. This big gasser was capped on the following day, December 28th, and its production turned into the mains of the Gas Belt Fuel Company, which in turn supplies the city of Chanute, Kans. The big well on the Spong tract, with its two companions, could alone supply the city without being pushed to do it.

The Ash Grove Lime and Portland Cement Co. now have a total gas production of 115,000,000 cubic feet daily, and with the new accessions it will shortly reach 150,000,000. The company still has land undeveloped in the vicinity of its present tract, but it is believed to be gas-producing as well as their other holdings recently exploited for the purpose.

60,000 BARREL PORTLAND CEMENT CONTRACT.

The Newton Engineering Co., Milwaukee, Wis., has awarded the contract for furnishing Portland cement for the \$370,000 reinforced concrete viaduct to be built across the Menomonee Valley at Grand avenue, to the Milwaukee Cement Co., Plankinton Bldg., Milwaukee. Marquette Portland Cement, manufactured by the Marquette Cement Mfg. Co., Chicago and La Salle, Ill., will be used. This is the largest

company, 960 N. Francisco street, Chicago, have just issued a very handsome catalogue which should be in the hands of every contractor. The catalogue is illustrated extensively with cuts of their derricks. Write for one today.

TRADE NOTE.

Parker Hoist and Machine Company individual cement contract for a single piece of work ever let in Milwaukee.

CONCRETE DRY KILN.

One of the largest concrete dry-kiln in the Northwest has just been completed by the Western Engineering company for the St. Paul & Tacoma Lumber Company at Tacoma, Wash. The kiln is divided into three compartments, two of them twenty feet wide and 120 feet long, while the third is forty-two feet wide and 104 feet long. Within sixteen days after the contract was let the Western Engineering Company had the roof in place. Three hundred and seventy-four cubic yards of concrete and 33,000 pounds of steel have been used on the work. The smaller compartments have been given clear spans of twenty feet, while the larger compartments has a forty-two-foot span beam. The roof is designed to carry a load of forty pounds to the square foot, and is five inches thick, being reinforced in two directions with steel rods.

The Aetna Portland Cement Co., now in the hands of Lawsone Becker, of Fenton, Mich., as receiver of the U. S. Circuit Court, Receiver Becker, in his report to the Court, states that when the receiver took charge of the plant last April its assets amounted to \$90,000, whereas on the first day of January, 1908, they inventoried at \$115,943.60. During the time the plant has been in the hands of the receiver, 188,882 barrels of cement have been manufactured. At present there are 41,828 barrels on hand, as compared with 18,591 last April.

The Southwestern Portland Cement Co. is to push the construction of its plant at West Dallas, Tex., so as to be completed by November 1st, 1908, from 400 to 500 men are to be placed on construction work at once.

The McAlester Portland Cement Co. has been organized to be financed by eastern capital except \$50,000 to be furnished by local McAlester parties. The officers of the company are Prof. Gould, state geologist, of Norman, Cleveland county,

Okla.; treasurer, J. F. Riley, treasurer of Oklahoma City; vice-president, A. C. Farmer; secretary and manager, H. E. Swan, McAlester, Okla.

The German Portland Cement Co.'s project, which was to build a cement plant at Chanute, Kans., has been abandoned. Parsons, Kans., and Arkansas bankers were behind the enterprise.

The Denver Portland Cement Co. of Denver, Colo., incorporated for \$2,000,000. The incorporators are W. S. Campbell, F. L. Perry and T. H. Savery. The directors are F. W. Crocker, W. S. Campbell, T. H. Savery, Jr., F. L. Perry, E. F. Perry, all of Denver, T. H. Savery of Wilmington, Del., and W. S. Taylor of Pittsburg, Pa. The company has purchased the old paper mills plant for \$75,000, which will be overhauled and converted into a cement mill. The stock is one half preferred and one half common.

The output of the Peerless Portland Cement Co. at Union City, Mich., was 400,000 barrels of cement in 1907.

ALPHA PORTLAND CEMENT COMPANY OFFICERS.

The annual meeting of the stockholders of the Alpha Portland Cement Company of Pennsylvania was held on Tuesday in the main offices at Easton, when the following were elected directors: W. M. McKelvey and J. H. Lockhart, of Pittsburg; John B. Wright, of Mt. Clair, N. J., and A. F. Gerstell, F. G. McKelvey and G. S. Brown, of Easton. The Board organized by the election of the following officers: President, A. F. Gerstell; secretary, F. G. McKelvey; treasurer, G. S. Brown.

A new industry will be established by Grimes Bros., of Franklin, Minn., shortly. They will manufacture cement blocks for sidewalks and tiling and circular blocks for silos.

The Concrete Block and Supply Co., of Wausau, Wis., has closed a contract to supply three car loads of cement trimmings for a new public school building at Galesville, Wis.

The people of Farmington, Minn., have a cement proposition under consideration. Authorities state that Farmington has the shale and stone for high grade Portland cement.

A company of Biwabik citizens are going to take up the manufacture of cement blocks at Sparta, Minn. The capital stock is to be \$25,000. \$6,000 to be spent for machinery.

NOTICE to the CEMENT TRADE.

The North American Portland Cement Company announces to Portland cement manufacturers and to the trade generally that it controls the

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ALPHA	LAWRENCE	LOUISVILLE	NORTHAMPTON
AMERICAN	DEXTER	EDISON	PENNSYLVANIA
PHOENIX	PENN-ALLEN	CATSKILL	

Other applications are under consideration.

For a limited period, the North American Portland Cement Company will, upon liberal terms, grant to existing and properly equipped cement plants, licences under the above mentioned patents and releases for past infringements.

All concerns continuing the use of pulverized coal in infringement of the above mentioned patents will be vigorously prosecuted. Infringement suits will shortly be commenced against such concerns.

North American Portland Cement Co.
30 Broad Street, New York

NOTICE
to the
CEMENT TRADE.

The Edison Long Kiln Patents covering the use of the *modern long kilns*, considered essential in the up-to-date Portland cement plant, are now controlled by the

*North American Portland
Cement Company*

Many leading cement companies have taken licenses under these patents.

For a limited period, further licenses and releases for past infringement will be granted on liberal terms to existing and properly equipped cement plants.

Concerns persisting in unlicensed use of these inventions will be vigorously prosecuted. Suits will shortly be commenced against such infringers.

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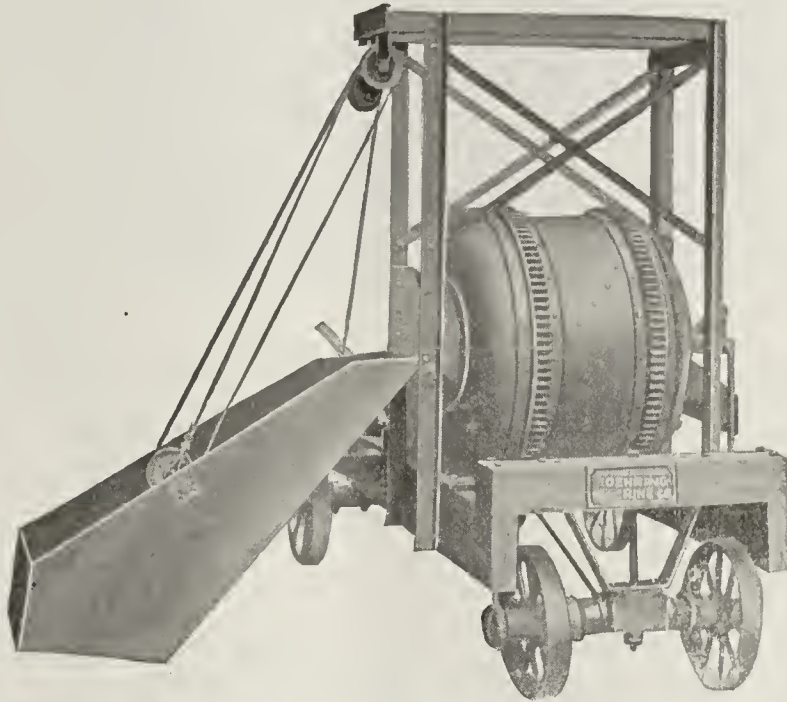
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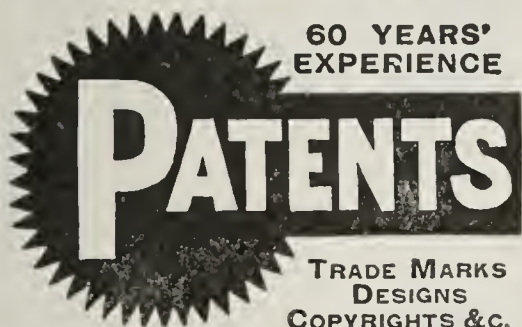
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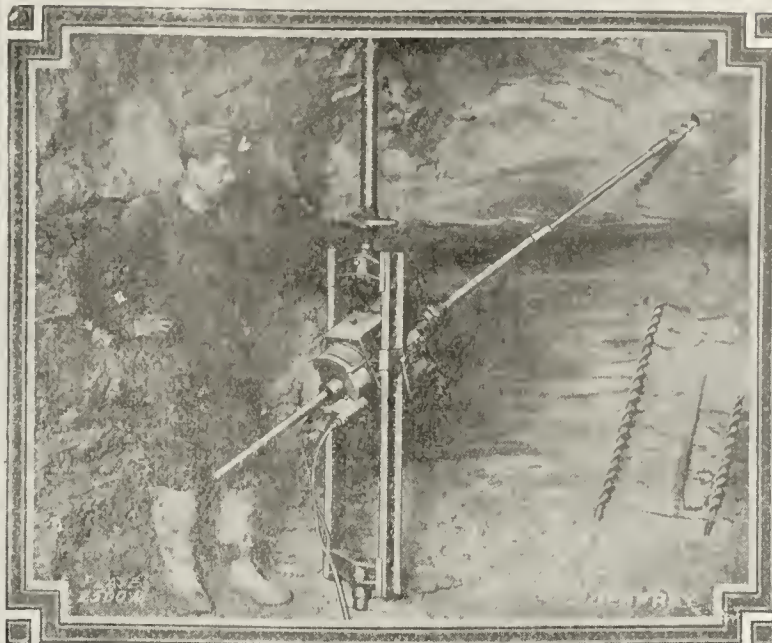
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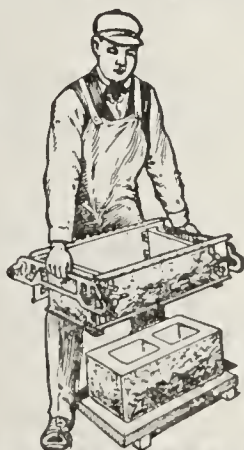
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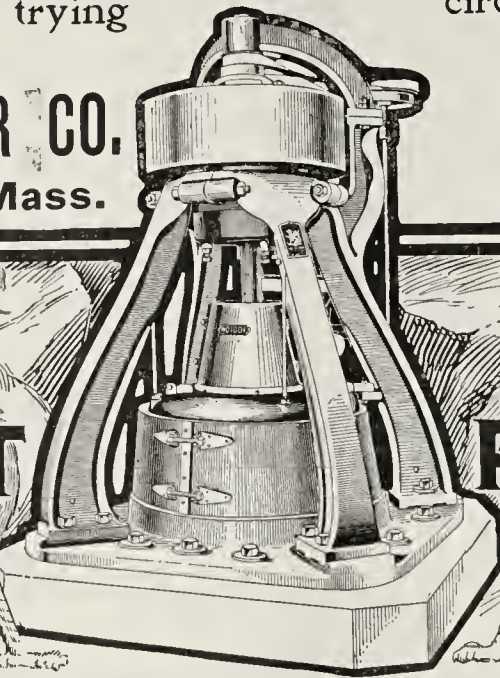
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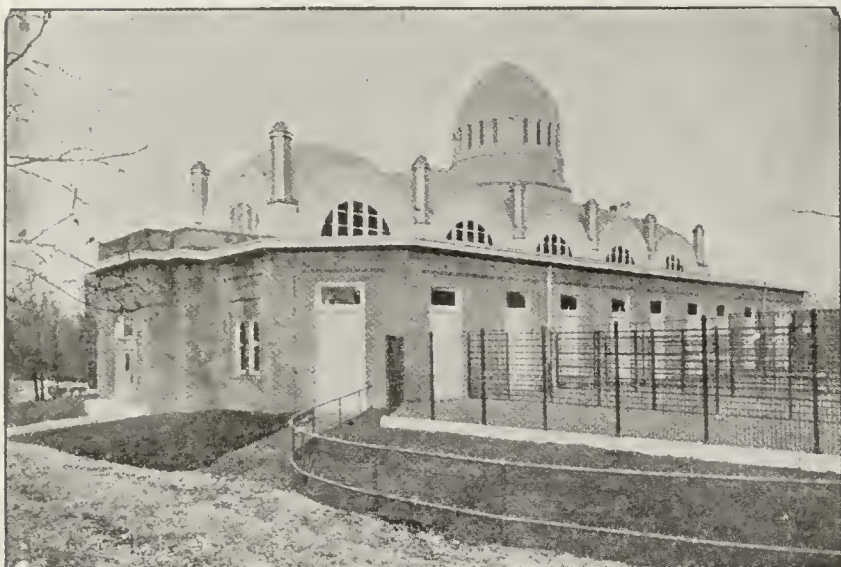
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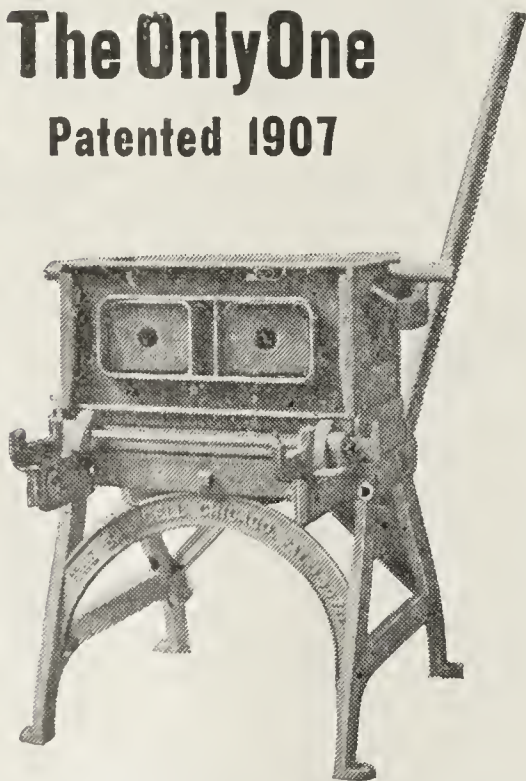
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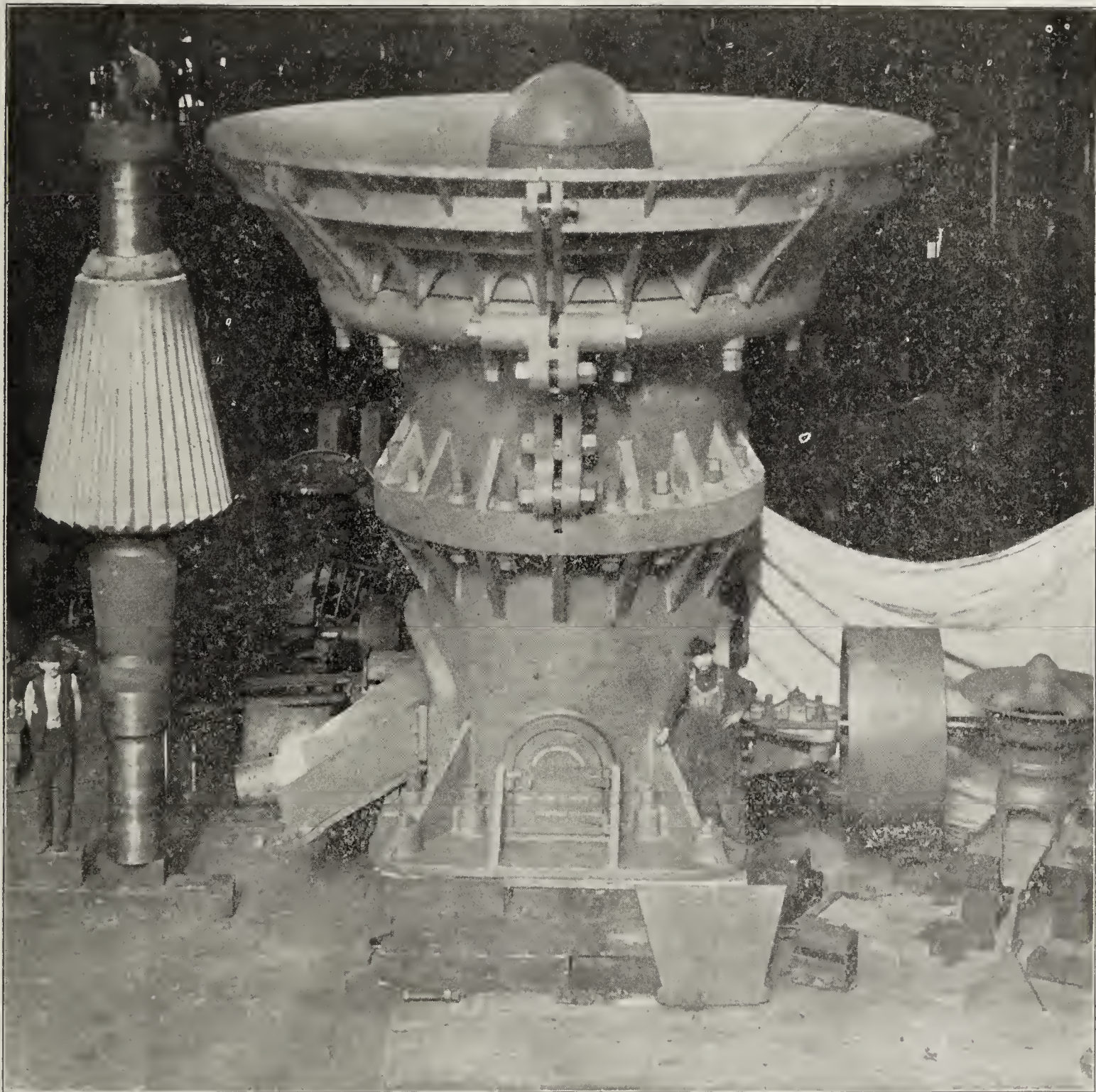
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(See Page 59.)

CEMENT AND ENGINEERING NEWS

(PUBLISHED MONTHLY)

WILLIAM SEAFERT, Editor and Publisher

OFFICE—22 Fifth Avenue

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Advertising Rates Sent on Application

JOHN F. WALDRON, Advertising Manager

CHICAGO, MARCH, 1908.

CORRESPONDENCE.

We solicit correspondence on all matters of general interest to the cement trade in all its branches. Engineering notes, public improvements, and facts and opinions drawn from practical experiments will be welcome.

BUSINESS CONDITIONS EAST AND WEST.

Business conditions are not in as good shape at present as during the opening of the season in the building industry in 1907. From Ohio eastward, the outlook is bad for a speedy revival of trade. The manufacturing industries are most depressed throughout the extreme eastern states; even in the city of Washington, which, in the main, depends upon funds paid out by the Government to its officers, and employes, at about the same rate during bad and good times, is suffering a local trade depression. This is accounted for by the fact that the Government employes have been sending portions of their salaries to friends in need in other states. West of Indiana, trade is in a much better condition due to the good crops of last year, which the farmers sold at fair prices. The farmers are profiting by the lower prices on manufactured goods. In the South, the planters who refused to sell cotton at less than fifteen cents per pound, are still holding onto their crops, upon which they might have realized eleven cents, but the price has now declined to nine cents per pound. The failure to market the crop makes a tight money market in the South, depressing trade conditions throughout the cotton belt. The night riders in Kentucky are holding the tobacco planters in duress, preventing the marketing of that crop. Western bankers who carried deposits in New York banks during last year's panic, could not realize on these deposits, while Chicago banks dealing with the same west-

ern banks, met their calls for cash with reasonable promptness, the result being that western bankers now deposit their idle cash with the Chicago banks, to the detriment of the New York banks. Money in Chicago is therefore easy, and seeking investment for legitimate enterprises. The cement trade centering at Chicago is in a fair condition. Cement salesmen on the road report trade much improved, good sized orders being taken in almost every town. We in the West, can scarcely realize the depression in the East, and its consequent stagnation of trade.

PORTLAND CEMENT MORTARS AND THEIR CONSTITUENT MATERIALS.

By Richard L. Humphrey.

A bulletin has just been issued by the Technologic Branch of the United States Geological Survey on "Portland Cement Mortars and their Constituent Materials," giving the result of 25,000 tests at the Structural Material Laboratories of the Government, at St. Louis, Mo.

The author of the bulletin is Richard L. Humphrey, engineer in charge of structural material investigations. The following synopsis of the bulletin is by Joseph A. Holmes, expert in charge of the Technologic Branch:

The records reported are based on 25,000 tests, extending over more than one year of active field and laboratory work. The report may be divided into two parts—the first, dealing with tensile, compressive and other tests, including chemical analyses of Portland cement of different brands donated for the purpose, and of the mortars mixed therewith in which a standard sand was used; the second, dealing with tests of mortars prepared by mixing typical Portland cement with 22 sands, 12 gravel screenings and 25 stone screenings, procured from different parts of the United States and mixed in different proportions.

In order that tests extending over a period of years might be made with relatively uniform cement, a quantity of Portland cement of seven different brands was obtained by donation. An equal amount of each of these brands was mixed together to form a typical Portland cement, and the mixture was stored away in air-tight cans. Tests, made to determine the quality and variation of the typical Portland cement, were conducted in great detail both on the neat individual brands and the typical mix, and on 1:3 cement mortars made therefrom with standard sand.

The results of the tests showing variation in tensile strength with age of neat cement indicate clearly that the typical mix reached maximum tensile strength in 90 days, or at the same period at which this strength was reached by the separate brands; that it maintained the highest tensile strength for a period as long as that of the best of the individual brands, viz., to 180 days, and that the diminution in tensile strength thereafter to one year and beyond was less than for some brands and no greater than for the best.

The tests of the standard-sand mortars showed maximum strength of the mix at 90 days, or about the same as for the individual brands; more rapid falling off in tensile strength for the mix, up to 180 days than for the individual brands, but an actual gain in strength beyond the 180 days for the mix, as compared with a falling off of the separate brands.

In the compressive tests the typical mix showed a rapid rise in strength, as did the individual brands up to 90 days, and a less rapid but continual increase in compressive strength to the 360-day period for the mix as compared with some of the brands, four of which showed little or no gain in compressive strength after 180 days.

Compressive tests of the 1:3 standard-sand mortars showed a more rapid gain up to 180 days for the typical mix than for the separate cement brands, and continued increase in compressive strength beyond 180 days for the mix, as against a less ratio of increase for several of the individual brands tested.

The general indications of these tests are that a better cement—that is, one exhibiting greater uniformity of behavior—is likely to be procured by making a typical mix of several brands than by the use of any one standard brand of cement.

It should be borne in mind, however, that this statement is applicable only to the typical mixes used in these tests, and that it is possible that other mixtures of Portland cement might not yield the same results, but would show entirely different characteristics. Results of further investigations along these lines will be reported as soon as they become available.

A study of the percentage of gain in strength exhibited by the various cements and cement mortars tested shows the very important fact that though the cements may test low or high at 7 days, and though there may be varying per-

centages of increase during the four periods from 7 days to one year, yet after the 180-day and the 360-day tests the strengths of all the standard-sand mortars were reasonably close one to another. This indicates that early strengths may vary considerably without seriously affecting the later strength of the cement or mortar.

The purpose of the investigations of the constituent materials of mortar was to ascertain as far as possible the properties of such materials collected in different parts of the United States. It is believed that the results of these tests made on material obtained near the large commercial centers of the country will indicate clearly to users of cement and of concrete where they may most conveniently and cheaply procure the requisite sand, gravel, etc., and how these should be mixed to attain the best result in tensile or compressive strength for each group of constituent materials.

A study of the data in this part of the report should afford a means of determining the probable strength of mortar made from materials having similar properties, though gathered in different parts of the country, and should aid the constructor to decide which of three materials, sand, gravel, or broken stone screenings, will best serve his purpose.

The tests whose results are here presented were made on mortars using different proportions of the typical Portland cement and sands, gravel screenings and stone screenings collected in various parts of the country, the properties of which are discussed in the earlier part of the bulletin. The report describes the material, the locality of its occurrence and the methods of screening, grading, etc., employed. The relative proportion of larger or smaller particles in the materials tested is not only described in detail and diagrammatically, but is well illustrated by reproductions of photographs made to exact scale.

Considering these tests in respect to the percentage of voids it appears that the tensile strength decreases with the increase of void spaces. The strength of the mortars is invariably much greater when made from sands having a small percentage of voids than when made from sands having a large percentage. The strength of mortars of different proportions is also greater for those sands which have a small percentage of voids. This condition is the same in regard to both tensile strength and compressive strength, and indicates that the greatest strength can be obtained by the use

of mortar in which the sand is uniformly graded. The same is true of tests of transverse strength, except that the difference is not so marked as in the tensile and compressive tests.

The tests show a greater uniformity in general when made at the end of 180 days than when made for shorter periods. The early strength appears to be easily affected by alteration in environment and the regularity for the earlier periods appears to depend on the nature of the cement.

In tests of density of mortar, it appears that the density values are greatest for the least percentage of voids, and that the weight per cubic foot and the strength are greatest under the same conditions. In the tests of mortars made with gravel screenings only that material which passed a 1-4-inch screen was used, and this amounted as a rule to less than 40 per cent of the sample received at the laboratory. As in the description of tests of mortars made with sand, complete details are given of the diameter of the particles in inches, with number of sieves passed; of the place in which samples were taken, and of physical and chemical tests. In these tests there is apparently a greater lack of uniformity in the increase of strength probably owing to physical differences in the gravel screenings. In general the tensile strength seems to increase with the decrease in percentage of voids. This is also true of the compressive strength. There was great irregularity in the results of tests on account of the difficulty in obtaining a thoroughly uniform mass, especially when the material was composed of coarse grains of approximately one size. In this case it invariably happened that the cement and gravel screenings occurred in many of the test pieces in streaks, the cement accumulating on one side of the neck of the test briquet, thus reducing the active section and possibly furnishing one element of weakness.

The tests of stone screenings collected in different parts of the country were made in the same manner as those described for sand and gravel screenings. Samples were also collected as described for the other tests. The results of these tests showed that in general the mortars made from screenings that are most nearly uniform in grading have greater strength than those made from the finer screenings, farthest removed from uniform grading. Also the strength of mortars made from the samples having a lower proportion of voids is greater than that of mortars made from screen-

ings in which the voids are greater. This appears to be true also of the compressive tests, in which the strength of the mortar is greater for samples most uniform in grade. As shown by these tests the transverse strength does not vary much after 90 days. The tests indicate that no definite law can be given by means of which the strength of mortars made from stone screenings can be approximately foretold from the mechanical conditions, because the strength of the stone itself from which the screenings are derived has an important bearing on the strength of the resulting mortar. The same tendency was observed in the stone-screenings mortars as in the gravel-screenings mortars for the cement to concentrate at one or more parts of the test briquet sections.

This report is the second of a series now in process of publication by the Technologic Branch of the Geological Survey. It is preliminary to a group of reports which describe in detail the results of tests of various structural forms made of concrete and reinforced concrete at the Structural Materials Testing Laboratories of the Survey, at St. Louis. Bulletin No. 329, the first of this series, describes in detail the organization, equipment and methods of test adopted at these laboratories. This second bulletin, as summarized above, describes the investigations leading to the adoption of a typical Portland cement for testing purposes and the tests of mortars made by mixing sand and its substitutes, gravel and broken stone screenings, with such typical cement, as an experimental study in the progress of the survey of the constituent materials of cement mortars and concrete in the United States.

A succeeding bulletin will describe tests of the solid stone from the same quarries as those from which were obtained the stone screenings on which the tests described in this report were made. These results may afford some basis for comparison of the relative values of mortars made from the stone screenings described in this bulletin. Other reports will deal with the results of tests of the constituent materials of concrete as distinguished from those of mortars, and with the results of additional tests of the constituent materials of mortars. These papers will be followed by a preliminary report of the results of tests of plain concrete beams and of cement-mortar building blocks. The same constituent materials have also been assembled in the form of reinforced concrete columns, many tests on which have already been

completed, and the results are now in preparation for publication. Other reports in this series will include results of investigations of shear and the modulus of elasticity in tension and compression.

Parallel with this series of reports of the results of tests being made at the St. Louis Laboratories there is to be published a report on the results of a series of tests made in the testing laboratories of various technological institutions. These tests were made in co-operation with the structural material laboratories of the United States Geological Survey and the joint committee on concrete and reinforced concrete of the engineering societies.

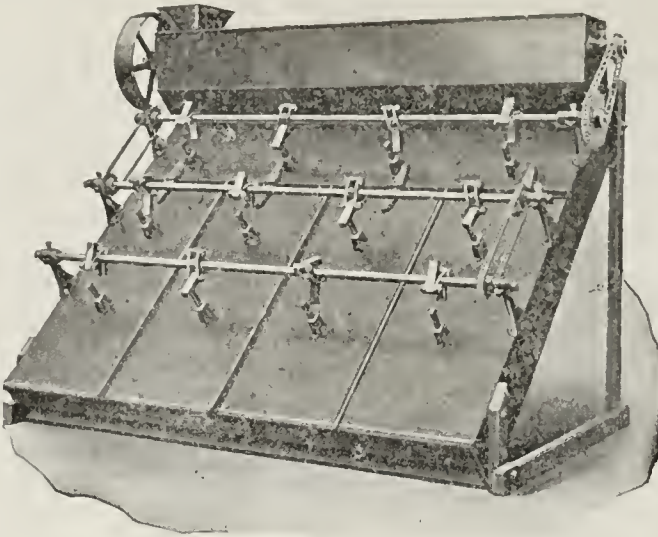
A NEW PRINCIPLE IN SCREENING.

More than 2,000 years B. C. the Egyptians made a screen of interwoven reed, enclosed in a frame, filled the frame with material to be screened and then began to shake. For four thousand years we have blindly followed their idea, and although we have improved on the screen itself, we have continued to shake—shake—shake. For years we have wasted energy and money in shaking our screen frames and their attendant mechanisms to pieces, to say nothing of the wear and tear on the screen itself, and all this with very indifferent success as regards the screened product.

It was for Mr. W. J. Bell of the Newaygo Portland Cement Co., Newaygo, Mich., to suggest the alternative in this case. The frame to his Separator is rigid; the screen frame is not shaken, but the screen cloth itself is vibrated like a piano wire. This seems to solve the vexed question of economical screening.

This Separator, styled the "Newaygo Separator," is an inclined, vibrating screen, framed in steel and enclosed in steel. The screen cloth is automatically kept in strong, uniform tension, and is vibrated by small hammers and constantly tapping its protected surface. This remarkably simple and ingenious device for producing vibrations secures astonishingly rapid and sharp movements, yet of small amplitude. These indestructible vibrations give material in process of screening the least possible projection, and offer it innumerable opportunities to pass through the clean screen openings before tailings escape at the foot.

Owing to the rapid and continuous small, but highly effective screen-cleaning vibrations of the screen cloth, the material, if sufficiently dry, never clogs. These small cleansing shocks cannot become

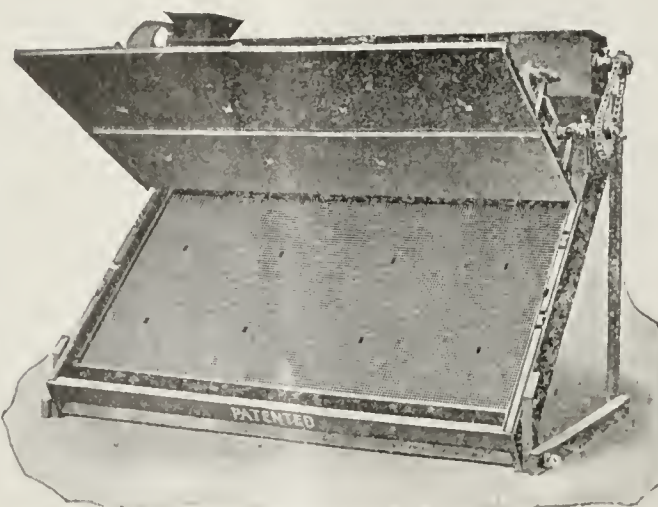


deadened because the screen automatically maintains its required tension.

An inclined vibrating screen must necessarily have a much larger capacity than others, because it cannot so easily clog, because all its surface works all the time, and it is no small advantage that coarser wire and meshes can be used to produce the same output than are possible in the old constructions. Large wires are clearly more durable than small ones. In an inclined, vibrating screen coarse wire can be successfully used for very fine work, because inclining the screen surface diminishes the size of the openings, and the little, sharp vibrations keep the pores open.

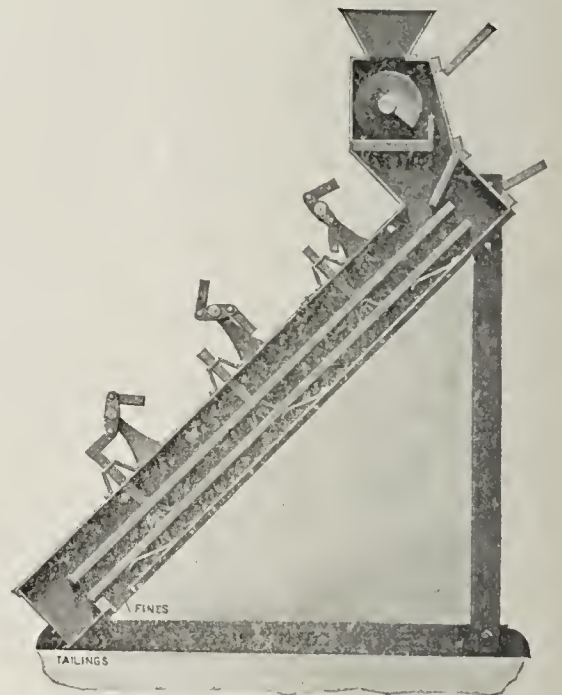
Material in process of screening will not race down an inclined, vibrating wire surface, nor will it leap far, and thus skip many opportunities of escape; nor will it bounce on the wire with cutting force, but partakes of a steady flow with millions of little screen-cleaning shocks that open the pores and constantly invite the escape of the finest materials long before they have reached the foot of the screen.

The fineness of output can be controlled to a considerable extent by changing the inclination of the screening surface (this change being made by moving the adjustable supporting legs), which, as we know, has the same effect as diminishing the screen mesh. The opportunities for material to pass through the



clean meshes of a vibrating screen are so infinitely more numerous than in the old "shaker," or round screens, that the tailings, even in rapid work, and with small meshes, must be much cleaner than usual. The screen, or screens (one or two screens of any mesh up to 100 may be used), can be readily withdrawn for replacement or cleaning.

The output that may be obtained from "Newaygo Separators" is from one-half inch up to 200 mesh, with capacities varying from 40,000 pounds per hour down to 1,000 pounds, according to the material and fineness of screen cloth.



Mr. Bell has seventeen of these inclined, vibratory separators in constant use at the Newaygo Portland Cement works, and believes that the problem of simple, economical screening has been solved.

The Sturtevant Mill Company of Boston, Mass., has underwritten this separator, and hereafter it will be sold exclusively by them.

In view of the fact that a bill is pending in Congress, which provides for the transportation of all Panama Canal supplies in American bottoms, Secretary of War Taft has postponed the opening of bids for 4,500,000 barrels of Portland cement to be used in the Panama Canal construction work.

The Pen Allen Portland Cement Co. is distributing a calendar memorandum book for 1908. It contains much useful information for contractors and cement workers, to be had on request by addressing The Pen-Allen Portland Cement Co., Allentown, Pa.

THE McCULLY CRUSHER.

The rapid increase in the use of crushed stone for concrete work, road making and railroad ballast, together with the great expansion of the Portland Cement industry in the United States, has called the attention of progressive quarry managers and cement engineers to the possibilities of effecting economies in the crushing of stone. The great saving in labor at the crushing plant, effected by the use of what heretofore has been considered large crushers, has been marked, but these crushers have not made as great savings in the quarry itself as would be desirable. The difficulty of obtaining a sufficient supply of suitable labor to operate the quarries to the capacity demanded by the great requirements of engineering work, which depend upon a steady supply of crushed stone, added to the cost of both labor and powder for breaking down the stone to sizes suitable for feeding the largest gyratory crushers heretofore in use, has emphasized the desirability of providing a crushing machine which will take any stone that can be economically handled by a steam shovel.

Although this need has been apparent for a number of years, it has remained for the Hunt Engineering Company of Iola, Kansas, Mr. Leigh Hunt, president, in their work as designers and constructors of complete cement plants, to take the first step in the direction of supplying this need. The result has been the design and construction, by the Power and Mining Machine Company of Milwaukee, Wisconsin, for the Hunt Engineering Company, of the Mammoth McCully crusher, which is here illustrated. The first machine of this size was installed and has been in operation for several months at the plant of the Dixie Portland Cement Company, South Pittsburg, Tenn., a second one having already been ordered for another plant to be constructed by this company and to be located at Des Moines, Iowa. The crusher at South Pittsburg, Tenn., has exceeded in every way the results expected of it by the Hunt Engineering Company, and it has been found by actual test that even less horse power is required to reduce the same tonnage with a crusher of this size, than with smaller crushers working continuously. The astonishing fact has also been demonstrated that this crusher, which will take stone up to 36 inches in thickness, produces a product, 100 per cent of which will pass through a

6-inch ring, 70 per cent of the entire product will pass a 4-inch ring and 30 per cent of the entire product will pass a 2-inch ring. This crusher has been designed on the same lines as all of the other sizes of the well-known McCully crusher, only such changes in detail having been made as are required by limitations of shipping facilities and convenience in the operation of the machine. The crusher is fitted with a two-arm spider, giving two clear openings, each 36 inches in width by 138 inches in length, or a combined opening with the two arm spider of 36x276 inches. This crusher, as well as all other sizes of McCully crusher, is of the suspended head type and it is worth noting that it would be impossible to build a crusher of this size with any other method of support for the crushing head and shaft. The suspension device is identical with that of the other sizes of McCully crushers, that is, a steel sleeve on the shaft supported on a steel wearing ring, which, in turn, rests on a shoulder in the bore of the spider. The suspension sleeve is held in its proper position on the shaft by means of an adjusting nut, this latter being prevented from turning by a steel key which is inserted in a keyway cut half in the shaft and half in the adjusting nut. The point of suspension of the shaft being at the fulcrum point, there is a minimum of the sleeve on the wearing ring. This motion is a true rolling motion, in which particular it is entirely different from any other method of suspension yet devised. A further advantage of this method of suspension is that in adjusting the crusher for various sizes of product, the angle of the shaft remains constant so that the bearing of the shaft in the eccentric

remains perfect. In consequence of this design all complications in the construction of the eccentric are rendered absolutely unnecessary, the eccentric in this crusher being as simple a mechanical device as it is possible to design. This idea of simplicity has been carried through the entire design of the crusher under consideration, as well as in the smaller sizes of McCully crusher, for it is a self evident fact that the less complication there is about any piece of mechanism, regardless of the purpose for which it is to be used, the less trouble and expense there will be for the operator.

The illustration, which shows this crusher with the top shell made in two sections, gives a very good idea of the truly mammoth proportions of this machine. It is absolutely necessary to make the top shell in two pieces in order to bring the machine within the limit of width set by the railroad companies. The following figures regarding the proportions of the machine, further emphasize its enormous size:

	lbs.
Total weight of machine....	425,000
Weight of head and shaft only	65,000
Height from bottom of shell to top of hopper.....	23 feet
Diameter of hopper at top..	20 feet
Size of driving pulley, 66 in. dia., 32 in. face.	
Horse power required, depending upon the character of the rock, from 200 to 300.	

A new cement company is being organized by Mr. E. L. Buell of Detroit, Mich., to be known as the Marengo Portland Cement Co. W. P. Palmer of Ypsilanti, Mich., is director of the company.

IMPORTS OF CEMENT INTO THE UNITED STATES.

WHERE FROM	JANUARY				SEVEN MONTHS ENDING JANUARY			
	1907		1908		1907		1908	
	Quantity in lbs.	Value in Dollars.	Quantity in lbs.	Value in Dollars.	Quantity in lbs.	Value in Dollars.	Quantity in lbs.	Value in Dollars.
United Kingdom ..	2,800,000	\$ 9,983	5,384,000	\$19,830	168,648,264	\$542,009	132,182,225	\$480,615
Belgium	35,268,829	95,421	34,283,829	103,492	217,646,471	687,051	101,537,755	316,398
France	1,698,500	7,286			11,791,518	45,323	9,260,727	36,209
Germany	21,178,654	61,620	14,395,967	51,133	268,868,698	845,49	163,851,598	547,974
All Other Europe ..	729,349	1,551	1,323,818	4,667	20,097,670	57,829	3,840,082	13,209
British North Am. .	76,000	531	4,000	40	3,103,683	22,658	274,740	1,615
Other Countries ..		1,327	117,900	775	54,026,807	254,975	5,494,733	29,037
TOTAL	61,978,532	177,719	55,509,514	179,937	774,183,111	2,455,341	416,441,860	1,425,057
Domestic Exports of Cement, bbls. . . .	59,573	105,345	47,262	73,129	371,679	625,829	550,463	864,039

There were 11,112,644 lbs. of imported Roman and Portland Cement, etc., in the United States bonded warehouses in January, 1907, valued at \$32,670, against 19,698,068 lbs. in January, 1908, valued at \$53,316.

For seven months ending in Jan., 1907, there were 62,245 tons of asphaltum imported in the United States, valued at \$247,884, against 82,165 tons imported in seven months ending Jan., 1908, valued at \$308,558.

PORTLAND CEMENT PRODUCTION IN 1907.

The Portland cement producers of the United States have replied so promptly to the statistical inquiries addressed to them by the United States Geological Survey that it is now possible to make a very close estimate of the Portland cement production for the calendar year 1907. Mr. Edwin C. Eckel, in charge of the work on cement for the Survey, prepared the following statement:

Returns have been received from 87 plants, representing over 95 per cent of the Portland cement production of the United States. As the ten plants which have not yet replied include only two large producers, it is possible to make a fairly accurate estimate of the total cement production of 1907. The returns so far received indicate that the total output of Portland cement in the United States during the calendar year 1907 was approximately 48,000,000 barrels. This should be compared with an output of 46,463,424 barrels in 1906, and of 35,246,812 barrels in 1905.

Though the production of 1907 shows an increase over that of 1906, it is slight as compared with past annual gains in the cement industry, indicating that the Portland cement production of the United States has now reached a stage in its development where it is directly and promptly affected by general business depression. This fact was predicted in the Surveyor's cement report for 1906.

The year 1908 commences with a condition in general trade so unsatisfactory that its cement output will probably fall below that of 1907. Existing American plants have now a total capacity of about 60,000,000 barrels a year, and it seems unlikely that much more than two-thirds of this total capacity can be operated profitably in 1908. The only advantage of this condition is that it will act as a check upon fraudulent and foolish promotion of cement projects. There is still room for well-equipped and honestly managed plants, but the safety of the legitimate industry demands that promotion schemes be scrutinized carefully.

The principal trade occurrences of the past year may be briefly summarized, though details must be reserved for the final report. About a year ago the North American Portland Cement Company was formed, to handle the Hurry & Seaman coal-burning patents. Licenses were issued to a number of existing plants. Very recently the Edison long-kiln

patents and the Carpenter impinging-flame patents were taken in association and considerably over two-thirds of the American cement output is now produced under licenses from the associated patentees. The development of the patent-holding company is a factor which must necessarily exercise an important influence on the future of the American cement industry. It is expected that in the Federal Survey's final report on this industry for 1907 it will be possible to discuss this situation in greater detail and to present official statements concerning the status of the licensing companies.

An official statement that the cement required for the Panama Canal would be only 4,500,000 barrels has served to put at rest exaggerated ideas concerning the importance of this work to the cement trade. The further statement that bids would be asked for delivery of clinker on the isthmus, and that the Government might possibly erect its own cement plant there, are also of interest to existing American plants.

Of the new plants whose construction was undertaken or completed during 1907, a number were located in districts already important as cement producers. Several plants along the Pacific coast and in other Western States have located in fields not yet subject to overproduction. In the South only one important new producer is to be noted—the plant of the Dixie Portland Cement Company, at Copenhagen, Tenn. The district in which most new plants are now under construction or in contemplation is the area reaching from Iowa through Kansas and Oklahoma to northern Texas.

The city of Savanna, Ill., is making its own sewer pipe out of concrete, resulting in a saving of over 50 per cent in first cost; 24-inch clay pipe costs about \$1.00 per foot, not including breakage, while the same sized concrete pipe costs 43 cents per foot and gives better satisfaction. Keep the money at home by employing local labor. The Miracle sewer pipe forms are used in producing concrete sewer pipe at Savanna.

The Miracle Concrete Construction Co., of Minneapolis, Minn., has been incorporated with a capital stock of \$50,000, by R. O. Miracle, C. D. Russell, G. H. Deitor, and a number of others, for manufacturing concrete products, etc.

STEEL CENTERS AND LAGGING FOR CONSTRUCTING CONCRETE LINING FOR TUNNELS.

The steel centers and lagging shown by the accompanying cuts were developed some seven years ago by Mr. Geo. W. Jackson for constructing the concrete lining for the network of tunnels built for the Illinois Telephone & Telegraph Co., at Chicago, Ill. Subsequently the same contractor has used this style of centering in constructing many thousands of feet of telephone, water-works and sewer tunnels. The drawing Fig. 1 shows the center rib for one of the water-works tunnels, the 8-ft. circular tunnel known as the Blue Island Land Tunnel for the water supply of Chicago. The lagging shown by Fig. 2 is practically standard for all sections of tunnel.

The ribs are made of channels in four segments jointed together by rivetted angle lugs. The top and bottom joints, it will be noted, are on a bevel to reduce the chance of binding in taking apart. A cross strut or chord strut braces the two lower segments apart. The rib channels are set up with their flanges projecting outward, so that, as will be seen from Fig. 2, the end angles of the laggings hook over the flanges and lock ribs and lagging firmly together. Each panel of centering, it will be seen, is independent and self-contained, so that the centering is composed of approximately 3-ft. units, the parts of which are of such dimensions and weights that they can be readily handled by men in confined spaces.

In operation the floor concrete is put in first and brought to grade at the center. Then the two invert segments of the ribs are set up and the invert concreted behind the lagging units placed one at a time. The arch segments are then erected and the concreting completed, working up the arch from both sides by placing the lagging units one at a time. In practice instead of making at A and B the tight joint shown by Fig. 1, the arch ribs are made about an inch short at each end of the half circle and the space taken up by wooden wedges between the angles; these wedges can be driven out in striking the centers, allowing the ribs to drop free from the roof. The last or the crown lagging unit is concreted over the end.

This centering has several distinct advantages which are well worth investigating by contractors. It gives a particularly good inside surface. For tunnels up to 12 to 15 ft. diameters the stiffness of the channel of ribs is ample to maintain the shape without cross bracing, and



Fig. 1.

this leaves a free bore for material cars and for construction work. The centering units are small enough, 3 ft., to enable the lining to be kept as close to the face as is ever necessary; also the component parts of each unit are small enough to be easily erected, taken down and carried ahead. The life of the ribs and lagging is great and the various units are so simple and sturdy that damage is small and repairs are easy. The idea is of course to use the centering over and over, taking it down at the rear and erecting it ahead as the work advances. Knowing his daily progress and the time which the centers must stand before removal the contractor can readily figure the length of centering necessary to keep the work going.

Up to the present time Mr. Jackson has used this centering solely in his own tunnel work, but he has now made arrangements by which he will build it to the size and section desired and lease it to con-

tractors at a cost which will give a saving over wood centers. The centering is patented by Geo. W. Jackson, Inc., Chicago, Ill.

NEW CEDAR CLIFF STONE PLANT.

One of the largest and best equipped stone crushing and shipping plants in America has recently been completed by the Cedarcliff Stone Company at its works near Cedarcliff, N. Y.

An exceedingly interesting and important feature of this plant is the very complete system of elevators and conveyors by which the stone is handled throughout the numerous processes of preparation and shipment. This system may be divided into two parts. First, the series of elevators and conveyors which takes the stone from the crushers to the revolving screens and from thence to the storage grounds, and second, the series which delivers the sized product from the storage grounds to

cars or vessels as the case may be. The first system consists of three elevators and two belt conveyors. Each of these elevators is 65 feet high from center to center of wheels. They are all of the general types illustrated and are the same in construction and dimensions of parts. Two of these elevators stand side by side and are so located that they handle the product of a No. 9 Gates Crusher and four No. 6's. The stone from each elevator is delivered into a revolving screen from which the tailings go back to two 6's on each side and re-crushed. Everything which passes through the screens is received by the third elevator which stands directly in the rear of the other two, and which delivers it to the finishing screen in the top of the building.

The finishing screen separates the stone into 2" and 3-4" products and the screenings which pass a 3-8" hole. The screenings are carried by a 14" Century belt conveyor to the north of the building, a distance of 100 feet.

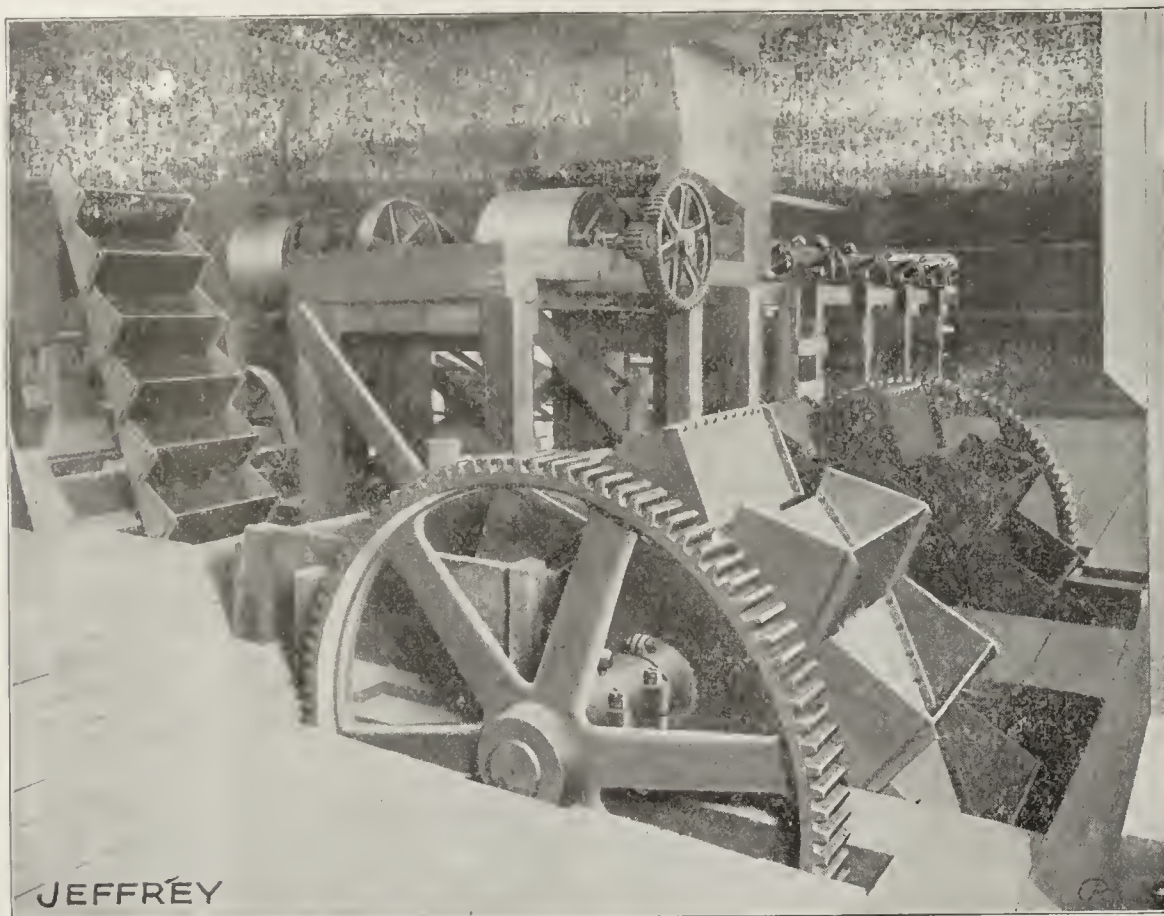
The 2" and 3-4" products are conveyed to the storage grounds at the south of the building by two separate belt conveyors, the belt for the concrete stone being 24" and the other 18" in width. These conveyors to the storage ground discharge the stone by means of an automatic tripper into the proper compartments for each class.

The plan of ground storage adopted by the Cedarcliff Stone Company is something unique in stone crushing plants and is, so far as we know, the first in which this arrangement has been adopted. Most stone crushing plants, as is well known, deposit the stone in large bins, which are not only costly to erect, but must be maintained at heavy expense. This ground storage plan is precisely the scheme commonly used for storing coal. The storage ground is 160 ft. long by 100 ft. wide, and the distributing conveyors are placed at an elevation of 35 ft. so that the storage capacity is about 8000 cubic yards.

The distributing conveyors over these grounds rest on concrete columns placed 35 ft. from center to center, each column being 12 ft. x 7 ft. in plan, and having a ventilating shaft 8 ft. x 3 ft. in its center from top to bottom. Underneath the column in the center and running the entire length of the storage ground there is a conduit or tunnel cut out of the solid rock. The cross section of this tunnel is 8 ft. x 8 ft. inside measurements and its length is 160 ft. The walls and floors are of concrete while the roof of the



Fig. 2.



Jeffrey Mfr. Co.'s Belt Conveyors.

tunnel is formed of 12" I-beams set 2 ft. apart and filled with concrete. In this roof, bin-gates are located six or eight feet apart the entire length. Over the tunnel, stone will be piled to a height of 35 feet.

For conveying this crushed stone to railway cars or barges, a 36" belt conveyor travels the entire length of the tunnel. By opening one of the bin-gates described, the stone from above falls onto the belt conveyor which delivers it to an elevator 45 ft. centers. This discharges onto another belt conveyor 36" wide x 200 ft. long, which carries it over the railway tracks to the wharf at the river's edge. The stone from this conveyor is discharged by a tripper either at the wharf for loading vessels or into a small pocket over-hanging the side tracks of the West Shore Railroad Company, where it is loaded onto railway cars.

This system of loading conveyors is designed for a capacity of about 400 tons per hour and is operated by an independent engine so that the barges or cars can be loaded without reference to the operation of the main plant.

A conspicuous feature of this elevating and conveying scheme is the great strength of the elevators. The buckets of all are 30" in length and are sustained by two parallel chains especially designed and made up for the heaviest possible work. The chains are the "Michigan" type of the Jeffrey Climax Steel Chain, except that they are made in double width in order to give greater bearing surface on the head and foot

wheels. They are designed to carry a steady load of from six to seven tons and as a factor of safety in strength of about 15 is allowed, it is reasonable to suppose that there will never be any serious trouble, even though the conditions under which they work are necessarily severe.

The entire elevating and conveying system was installed by the Jeffrey Manufacturing Company of Columbus, Ohio. It works with great smoothness and efficiency, and the management of the Cedarcliff Stone Company express themselves as being highly pleased with the installation.

BUILDING FOR THE AMERICAN SCHOOL OF CORRESPONDENCE.

The building recently erected for the American School of Correspondence, Chicago, is of particular interest from both the architectural and the educational point of view. In its external, visible lines, it harmonizes perfectly with the practical purposes of its design and the dignity of its surroundings; and it is also a center from which there radiate invisible lines reaching to the very ends of the earth. For here are the headquarters of the largest institution in the world exclusively devoted to correspondence instruction along technical lines—a quiet but forceful factor in the distinctly modern machinery of education, whose enlisted army of ambitious workers answer its roll call from every quarter of the globe.

The structure thus partakes to some extent of the nature of an office building as well as a school. Its design was, therefore, a complex problem dictated by several different considerations. Foremost among these, of course, was the intended use to which the structure was to be put—namely, as a school and a center of administration. Another factor of almost equal weight was its location. In the immediate vicinity of the magnificent Washington Park and the Midway Plaisance of World's Fair fame, an essential link in Chicago's great boulevard system, it not only has the advantages of surroundings of great natural beauty and artificial adornment; but, owing to its proximity to the University of Chicago, whose campus it faces and whose administration offices stand only two blocks



American School of Correspondence.

away, the School is itself destined to play an important role in directing attention to this section as the recognized educational center of the city. Here, around the University as a nucleus, is the destined site of Chicago's future "College Row."

This location for the School therefore, dictated a treatment in design that would in no wise conflict with the architectural scheme of the other educational structures which, in increasing numbers, are arising in the vicinity. The problem was to combine in the exterior design of a single structure the picturesque appropriateness to collegiate architecture and the solidity and stateliness required in an office building. This scheme has been worked out in the utmost simplicity.

The materials of the exterior are paving brick of two shades, with Bedford stone for enrichment, and moss-green tile in the roof. The brick used in the basement and projecting courses of the rustications, is of a purplish red, somewhat darker than that used in the body, its depth of tone being strengthened by being laid with dark joints. The brick in the body of the wall is a medium warm red, somewhat variegated, and thus having life and pleasing texture, its general contrast to the darker material being emphasized by being laid with white joints and by the white finish of the window sash and frames.

The building faces south. It contains four stories and basement. The general interior plan is that of the letter E, the return of the east and west wings inclosing on two sides an open court walled in at the rear and entered through an arched driveway.

The note of green struck in the roof tiling is carried throughout the interior wood finish of the building which is of quartered oak, the notes of purple and red also reappearing in the wall decoration, and the red in the polished granite of the entrance steps and in the flooring of the vestibule and corridor on the ground floor, which consists of plain red English quarry tile with broad, dark joints and relieved by occasional mosaics of glazed and varicolored tiling. The general interior color scheme is seen to best advantage in the vestibule. The high oaken wainscoting, the ceiling beams, and the furnishings are tinted a soft green, the walls and ceiling panels a warm buff relieved with unique, conventional flowered designs in red, green, and purple—the whole blending harmoniously and in pleasing contrast with the general darker tinting of the tiled floor.

In all its interior arrangements and appointments, the building is most admirably and completely adapted to the uses for which it was designed. The facilities, in fact, possessed by this institution for the conduct of its practical courses and the imparting of high-grade and thorough instruction, and the systematic methods that have been evolved as the result of years of experience in meeting the educational needs of those whom circumstances have denied the privileges of technical training at resident schools, are in themselves a revelation of typical American ingenuity and enterprise.

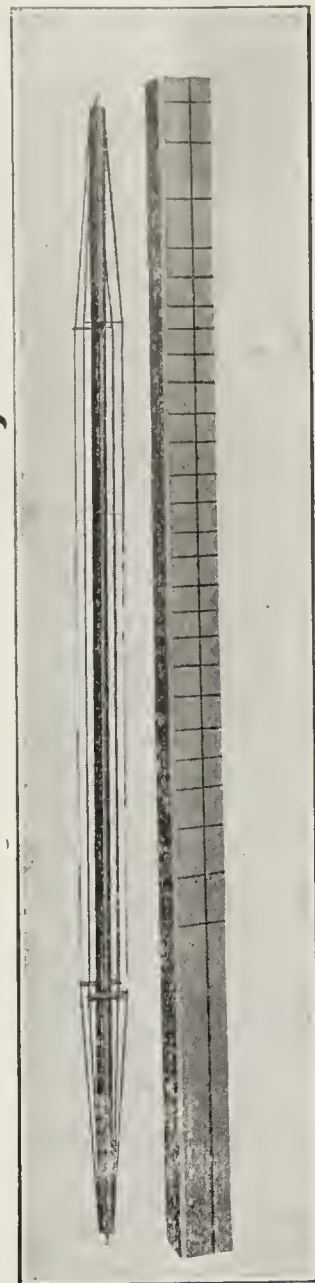
The offices of administration are on the second floor, the remainder of the building being used for the accommodation of the large staff of instructors, editors, and other employes in charge of the various details of the work of the school. An interior telephone system that has never been surpassed for completeness, has been put in, connecting all the departments with one another. For facilitating the work of the business office and mailing room, several of the latest electrical appliances have been installed, including an adding machine, a folding machine, and an envelope sealer—all operated by electric power. In the basement are the stock-room, the shipping-room, and also the steam heating plant. The system of heating is known as the "direct-indirect," the larger radiators on the several floors being located in juxtaposition to cold-air ducts leading from the outside through the walls, an abundant supply of fresh air being thus provided at all times. Electricity is used throughout for lighting purposes, all the corridors and larger rooms being equipped with Nernst lamps, the other parts of the building with incandescent lamps. Lavatories with hot and cold water are located on each floor.

Space would forbid any full description of the numberless details so admirably foreseen and provided for in the special design and execution of this remarkable structure.

Alfred Sydney Johnson.

OWEN'S CONCRETE FENCE POST.

The cement fence post is now a live subject with railway companies and farmers, both of whom are beginning to make extensive use of this new commodity. The many different kinds of fence posts now on the market may be classified as good, bad and indifferent. We il-



Owen's Fence Post.

lustrate herewith the Owen's fence post, simple in design and construction, as well as economical to produce. It consists of a double truss reinforcement composed of a sheet of steel tube, which forms the core; small plates at each end of this tube serve to secure the four wires. Truss-tie plates properly fastened on the tubes receive and hold the four wires which serve as extension members, all as shown in the assembled reinforcement. Thus assembled, the reinforcement is placed in molds, which are filled with slush concrete, producing a square post with grooves properly spaced along the length of the finished post, to receive the wire loops used to fasten the fence wire to the post. The reinforcing under the Owens system in a 6 1-2 ft. post weighs only three pounds, and will sustain 110 pounds without distortion. When enveloped in concrete it will carry 1,500 pounds. These posts have been adopted by one of the leading continental railway companies after thorough investigation. Two men with a mixing machine can furnish 200 posts in one day. The first cost of which does not exceed the price of wood and will last indefinitely. There

ought to be a good market for such a post. County rights for sale by the Chicago Reinforcing Co., 99 Washington St., Chicago.

The Freeborn Engineering & Construction Company of Kansas City, have been awarded the contract for the engineering and construction work on the plant of the Crushed Stone and Filler Co., at Sugar Creek, Mo. The engineering work has started and construction work will follow immediately.

SURFACE FINISH ON CONCRETE CONSTRUCTION.

In a recent paper Mr. M. C. Tuttle, Secretary of the Aberthaw Construction Co., of Boston, freely gives of the experience of this pioneer company in concrete construction, particularly as relates to the finish of concrete surfaces. Briefly told the different finishes and their characteristics are as follows:

Granolithic finish, secured by careful troweling, furnishes a good protection, is water tight, but not always satisfactory in appearance.

Rough picked work gives a pleasing surface with some variation in color, and if properly done is not injurious in its general effect upon the construction. It is particularly adapted to landscape and ornamental work.

A rubbed mortar surface can be obtained by the use of water and carborundum stone. This is an excellent finish for factory buildings and the like. It costs no more than picking.

An air blast finish can be given by inexperienced men with fair economy. This method was used by the Aberthaw Construction Co. in finishing the Stadium at Harvard University.

A hammered surface obtained by the use of the ordinary many bladed stone hammer gives a good finish for detail work and for concrete block.

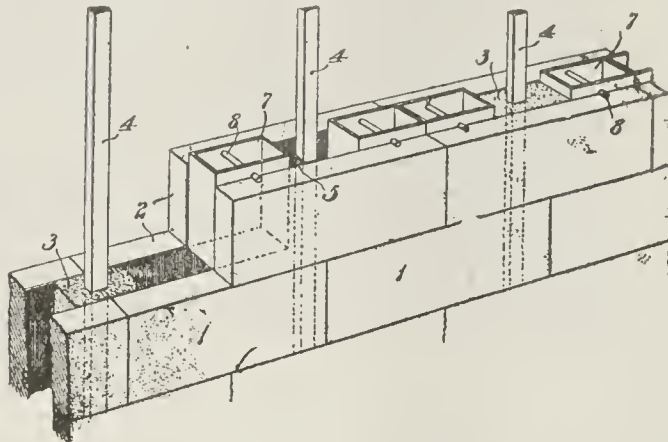
Sulphuric acid is sometimes rubbed into the surface with a steel brush, and the cement particles thereby dissolved away from the rest of the material, bringing out the color very effectively.

Mr. Tuttle considers that in the future there will be less attempt to shape the concrete in moulds corresponding to the finished size. It will be cheaper to make them smaller and plaster the surface, or use some other means of finishing.

U. S. PATENTS RELATING TO CEMENT AND CONCRETE.

875,983 Concrete Construction. John B. Clayton, Kirkwood, Mo. Filed May 20, 1907. Serial No. 374,643.

A wall construction comprising an inner and outer portion each of which is made up of rectangular-shaped concrete slabs arranged in courses, an approximately ring-shaped device partially embedded in the inner face of each of said slabs, being so disposed that the ring-shaped devices in the inner portion of the wall are located oppositely to

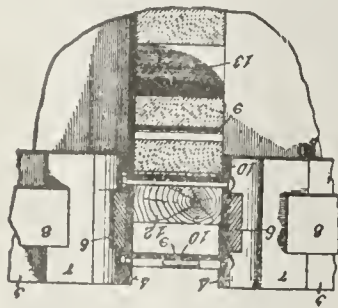


No. 1.

the ring-shaped devices in the outer portion of the wall, concrete posts interposed between said inner and outer wall portions and separated from each other to provide continuous air spaces, a vertically disposed metallic reinforcing member embedded in the concrete in each of said posts, and flexible connecting members secured to the ring-shaped devices in the oppositely disposed slabs of said inner and outer wall portions and being wrapped around the reinforcing members of the concrete posts; substantially as described.

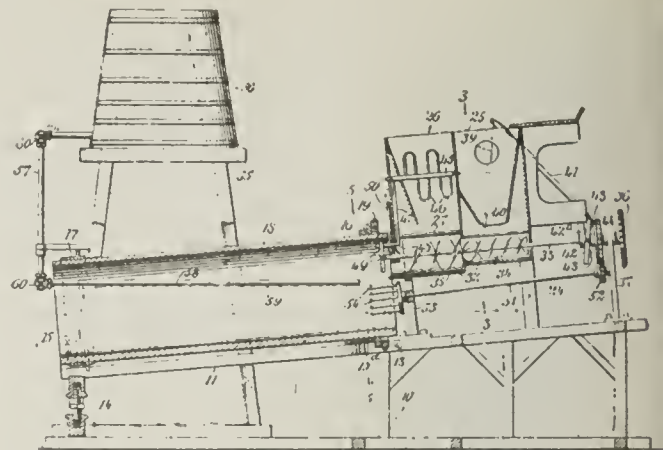
875,700. Mold. Paul T. C. Dumais, Hull, Quebec, Canada, Filed June 20, 1907. Serial No. 379,842.

2. A snap mold for concrete, comprising independent mold plates adapted to be assembled to constitute mold sections for providing continuous molding faces of any required dimensions, braces carried on



No. 2.

the back of said mold plates and provided with end recesses, locking plates fitting such recesses for locking plates constituting rigid backings extending across the joints be-

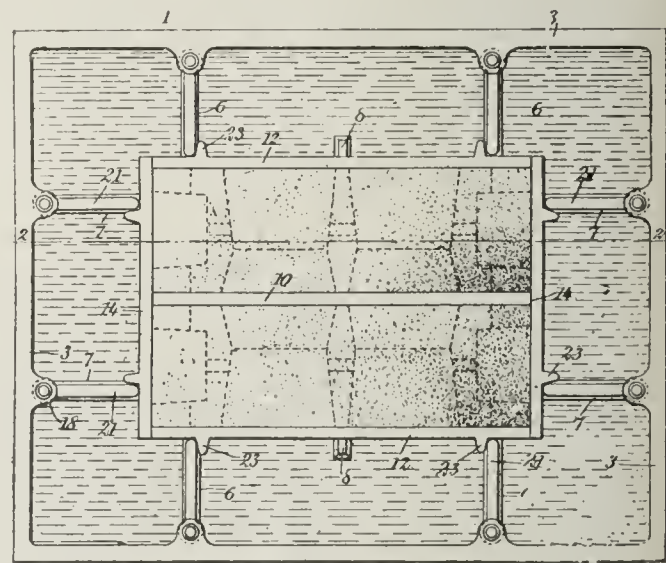


No. 3.

tween said abutting mold plates, and adjustable clamping means for clamping together said sections with any desired space between their molding faces, substantially as described.

876,270. Concrete mixer. Robert B. Fulton, Red Cloud, Nebr. Filed Jan. 11, 1906. Serial No. 295,565.

1. A concrete mixer comprising a main frame, a drum rotatably supported in the frame and inclined with respect thereto, a tank supported adjacent to the drum, a pipe leading from the tank into the drum, said pipe being perforated within the drum, a shaft having a disk adjacent to the drum at the upper end thereof, said disk having pins projecting from the face thereof and extending into said drum, an auxiliary frame connected with the main frame at the upper end of the drum, a sand hopper and a cement hopper supported by the auxiliary frame, means for feeding cement and



No. 4.

sand in unequal quantities, said feeding means delivering to the hopper immediately above the disk, and means for rotating the drum and disk.

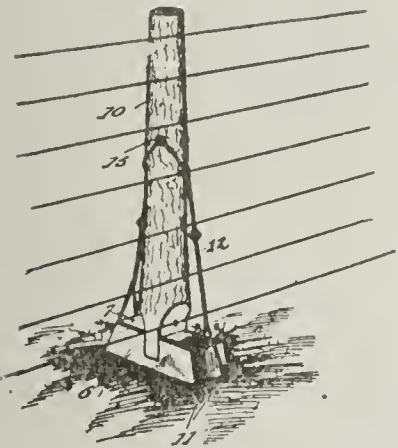
876,280. Concrete-Block Machine. Frank Morcher, Tiffin, Ohio. Filed Apr. 13, 1907. Serial No. 367.

1. A concrete block machine, comprising a casing, a mold within said casing having removable walls, means carried by said casing for

holding said walls in position within said casing, said casing being adapted to receive a facing liquid surrounding said mold, and means for removing said liquid from said casing.

875,039. Fence-Post. Charles S. Beebe, Peru, Ind. Filed Oct. 12, 1906. Serial No. 338,625.

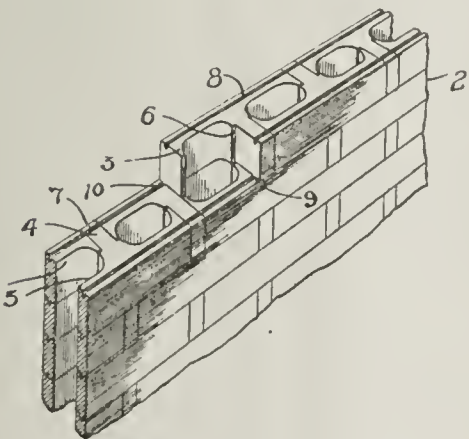
1. In combination, a plastic material base provided at its upper end with a post receiving slot extending completely across the same end formed with an arched floor, and a post secured to the base and fitted in said slot and having its lower end notched to receive said floor.



No. 5.

3. In combination, a plastic base having an intermediate post receiving slot, said base provided at each end with separated wire fastening means having metal reinforces embedded in the base, a post seated in said slot and having wire receiving projections a distance above said lower end, and twisted guy wires from said projections to said separated wire fastening means.

877,996. Concrete-Building-Block Wall. Francis M. Henry, Minneapolis, Minn. Filed Jan. 19, 1907. Serial No. 353,074.



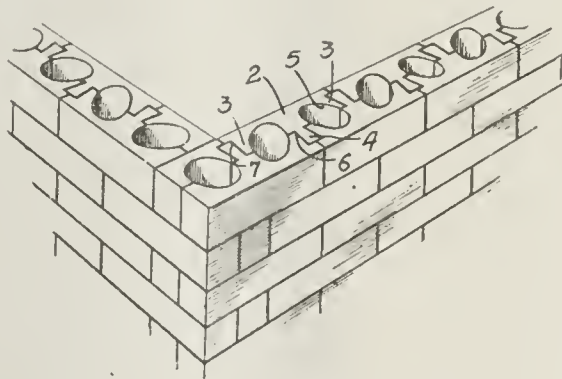
No. 6.

1. A wall composed of T-shaped blocks each having a rectangular head forming a stretcher with a tongue molded transversely on said head midway between its ends and forming a header, the

inner surface of said head on each side of said tongue being concave and the recesses therein extending continuously from the base of said tongue to points near the ends of said head, and the ends of said head having webs projecting therefrom in planes substantially parallel with the plane of said tongue and on the same side of the block, and the ends of said webs being co-incident with the longitudinal center of the wall, and the adjoining blocks in each horizontal course being reversely arranged and the webs on the head of one block abutting the tongues of contiguous blocks, and the surfaces of the heads and the ends of the tongues alternating in each horizontal course on both sides of the wall, whereby a Flemish bond construction will be formed, and said recesses forming when the blocks are placed in the wall a series of vertical air flues.

877,997. Concrete-Building-Block Wall. Francis M. Henry, Minneapolis, Minn. Filed Aug. 12, 1907. Serial No. 388,117.

1. A wall composed of T-shaped blocks, each having a rectangular head forming a stretcher with a dove-tailed tongue molded transversely on said head midway between its ends, said tongue having

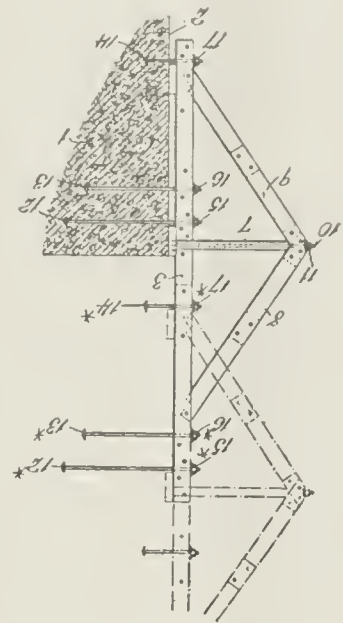


No. 7.

recesses on each side and the inner ends of said recesses coinciding with the longitudinal middle line of block and the inner surface of said head on each side of said tongue being concave and the ends of said head having webs projecting therefrom in planes substantially parallel with the plane of said tongue and on the same side of the block, and the ends of said webs being co-incident with the longitudinal center of the wall, and said webs having recesses in the ends of the block corresponding substantially to those on said tongue and into which web recesses the tongues of the adjoining blocks are adapted to fit, and the tongues in the block on one side of the wall being opposite the joint between the ends

of the blocks on the other side of the wall and invisible from said other side and the concave surfaces in the opposite blocks forming vertical flues, substantially as described.

78,155. Means for use in building concrete wall and the like. Robert W. Pommerer, New York, N. Y., assignor of one-half to William J. Gilson, New York, N. Y. Filed Aug. 4, 1906. Serial No. 329,151.



No. 8.

Means for use in building concrete walls and the like consisting of a facing truss comprising a vertical beam, upper and lower laterally extending planks, laterally and vertically arranged diagonal braces connecting said beam and said planks, means for securing the parts rigidly together and bolts removably secured to the upper and lower portions of the vertical beam.

878,639. Concrete Vault. Boyden Kinsley, Wyoming, Ohio. Filed July 26, 1907. Serial No. 385,655.

CONCRETE BLOCK FIRE TESTS.

A public test of the fire and water resisting properties of concrete building blocks was made at Birmingham, on March 11th, in the presence of Fire Chief Bennett, a number of city aldermen and officials of the Southeastern Tariff Association. The Fulenwilder Concrete Company erected a test building of concrete blocks on Eleventh and North streets; the structure was filled with cord wood, saturated with kerosene and fired. After a time the fire was extinguished by streams of water; the concrete blocks were found in good condition, and satisfactory to the fire department. Chief Bennett had doubted the fire resisting properties of concrete blocks, and to convince him the test was made.

LARGEST SINGLE OFFICE BUILDING IN THE WORLD.

The erection of tall buildings has come to be of such frequent occurrence, that scarcely has one time to become thoroughly familiar with the skyline of lower New York, before it is changed by the building of a new skyscraper. Public interest is always centered in the tallest building on record; but the City Investment Company's new building, which is now in course of construction, lays claim to distinction, not because it is of record height, but because it eclipses all others in the matter of cubic capacity and floor space. These figure up to 10,300,000 cubic feet and 500,000 square feet respectively. While the Hudson Terminal buildings will have a greater combined capacity; but as these twin structures are entirely separate from roof to street level, it is hardly fair to compare them with the City Investment Company's building. In the matter of height the latter surpasses every other structure in this city, with the exception of the tower of the Metropolitan Life Insurance building and the Singer tower. Measuring from the sidewalk level at the center of Cortlandt Street to the extreme top of the building, we have a height of 480 feet. The height above Broadway is slightly less, while that above Trinity Place is somewhat greater, owing to the difference in level of these two streets. The building occupies a frontage of 105½ feet on Trinity Place, and extends through to Broadway, where its frontage is but 37½ feet. A six-story building at the corner of Broadway and Cortlandt Street cuts out 56½ feet of the Broadway frontage, and 106 feet on the Cortlandt Street side, leaving a Cortlandt Street frontage of 209 feet. The Broadway frontage adjoins the addition to the Singer building.

A feature of the City Investment Company's building, which above all others impresses itself upon the observer, is the fact that a deep recess or court is formed in the structure on the Cortlandt Street side. The building is thus divided into four distinct portions, which are respectively known as the Central Building, the West Pavilion, on Trinity Place, and Cortlandt Street, the East Pavilion, and the Broadway Wing. The frontage on Cortlandt Street is unbroken up to the third story, but at this point the court begins, and extends to the top of the building. The central building rises above the rest of the struc-





ture, consisting of 33 stories, all told, while the two pavilions and the Broadway wing are but twenty-six stories high, or about 370 feet above street level. The object of having a light court on the street side of the building rather than on the inner side of the block is that it provides more light for the same area, and hence provides a larger number of light "outside" offices in the central part of the building.

The walls of the building are of Indiana limestone up to the sixth floor, and above this of special brick with terra-cotta trimming and copper cornices. A feature of the building is the arcade, which runs from Broadway clear through the building to Trinity Place. The arcade is formed with arched portals at each end, and occupies the entire width of the Broadway frontage. The height of the arcade is about 40 feet. It is finished in veined statuary marble with breche violette columns. The ceiling is barred vaulted and domed and elaborately frescoed.

Twenty-three elevators will handle the transportation of passengers. Twenty-one of them are arranged in three banks which open on the arcade, and run to the seventeenth, tenth, and twenty-sixth stories respectively. They are of the plunger type, and the excavations for the plungers of the elevators which will travel to the twenty-sixth story are probably the deepest bores ever made for this purpose. Above the twenty-sixth floor there are two electric elevators, which will carry passengers to the top or thirty-third floor level.

The building is carried on concrete pile foundations sunk to rock 80 feet below the street level. Unusually large foundation girders were required, one of which is a triple-web 90-ton girder 9 feet high, 27 feet long and 5 feet wide. The basement and the sub-basement, which extends 30 feet below the curb level, will have an area of 32,000 feet. It is estimated that the building will weigh about 86,000 tons, and the steel structure about 12,000 tons. A 2,000 boiler horsepower steam plant will be installed in the building for lighting, heating and power purposes. Besides the direct-heating system for the office rooms, an indirect heating system and fan ventilation will be installed for the basement and sub-basement. Water storage will be provided by two main tanks of 12,500 and 9,000 gallons capacity each. One of them will be located on the roof of the building, and the other half way

down to the street level, so as to divide the head water and reduce its pressure to a maximum of about 100 pounds per square inch. The usual stand pipes, hose, etc., are provided for use in case of fire, and these will be supplied from the upper tank.

The construction of the building is being rapidly carried on. At present writing the steel work has been completed up to the full height of the two pavilions and the Broadway extension, while the frame of the frame of the central building has been erected to the thirtieth floor. The building has been inclosed to the twenty-fourth floor at the front and the twenty-seventh at the rear.

The accompanying cut is reproduced from the Scientific American.

DEPRECIATION OF STEAM PLANT.

It is impossible to establish a hard and fast basis for depreciation of a power plant. But Mr. Charles T. Hain, mill engineer of Boston, very concisely presents the average conditions as follows:

With good water and good care, running about twelve hours a day, the life of a boiler should be about twenty years, or the depreciation five per cent. a year. Slow-speed engines, running ten hours a day, can be estimated as having a life of about twenty-five years, or a depreciation of four per cent. a year. High-speed engines are much shorter lived, and will not average over fifteen years, or a depreciation of about seven per cent. a year; and often times it is greater when run ten hours a day. The depreciation when run twenty to twenty-four hours a day is correspondingly greater. Boiler settings and piping should be included with the boilers, and engine foundations and piping with the engines.

The life of economizers varies with the initial temperature of the entering water from about ten years up to forty.

EARLY USE OF CONCRETE.

Fletcher's History of Architecture makes this distinction between Greek and Roman architecture: The Greeks constructed their buildings of large blocks of stone without mortar. The practical instinct of the Romans, instead of composing the walls of their monumental buildings of square blocks of stone, made use of concrete materials consisting of small fragments of stone or quarry debris, mixed with lime or mortar. The decoration of Roman buildings had little connection with the architecture proper, for

a Roman edifice built of concrete could receive a decorative lining of any or every kind of marble, having no necessary connection with the general structure, such decoration being an independent sheathing giving a richness to the walls, both internal and external. Roman architecture had the character, therefore, of a body clothed in many instances with rich materials forming a national and appropriate finish for the structure, and differing essentially from Greek architecture.

INCORPORATED.

Meramec Portland Cement and Material Company of St. Louis; capital, \$10,000. Incorporators, J. A. Daly, F. P. Boyd, H. M. Duck and other persons, all of St. Louis, Mo.

The U. S. Gypsum Co. will erect a two kettle gypsum mill at Eldorado, Greer county, Oklahoma, to employ twenty men and be in operation in July.

Chicago Concrete Engineering Company; capital \$50,000; engineering, contracting and manufacturing; incorporators, A. W. Rush, Walter Haas and W. G. Salter, of Chicago.

The Northwestern Portland Cement Co., of Mason City, Iowa, has closed an order for 18,000 barrels of cement to be used in the construction of three reinforced concrete bridges at Waterloo, Iowa, and an indefinite order from the city of Minneapolis for a greater portion of city work in paving, repairs and sidewalk work.

BADGER PORTLAND CEMENT CO.

Plans for the Badger Portland Cement Company's plant have been completed. The plans call for a 2,000 barrel plant to be erected at Sturgeon Bay, Wis., at a cost of \$1,000,000; work is to commence as soon as the weather will permit. E. A. Edmonds is President and General Manager, W. H. Simmons, Supt. A great water power dam is to be constructed at the falls of the Peshtigo river ten miles above Crevitz, Marinette Co., Wis., where electric power will be generated and transmitted to the plant by cable, a 20 mile cable which will cross Green Bay. The company's offices are at Appleton, Wis.

THE COLONIAL PORTLAND CEMENT COMPANY'S TROUBLES.

The meeting of the Colonial Portland Cement Co., of Wiarton, Ont.,

adjourned from Wiarton to London, Ont., on March 10th.

At the former meeting held in Wiarton there was found to be much dissension among the board, the president, Mr. J. W. Humphrey, of Detroit, being accused by some of having sold the stock of the company on margin, acting in the capacity of broker for the company of which he was president. Nothing could be done at the Wiarton meeting, and it looked as though the same deadlock would occur at the London meeting, as there was nothing done for many hours. The company was started some five years ago, and as yet it has hardly commenced operations, as a result of which there is much dissatisfaction among the stockholders. The alleged actions of the president were freely criticised Tuesday and for hours the meeting was nothing but an argument between those upholding his position and those who were criticising it.

Finally at 1 o'clock in the morning the following directors were elected: Mr. R. M. Piper, Lambeth, Ont.; Mr. John Morton, Chatham, Ont.; Dr. Whittier, Detroit; Mr. Webster, St. Thomas; Mr. D. H. Buhier, Detroit; Mr. D. A. Wright, Wiarton, and Dr. Teasdale, London.

The board at once held a meeting and elected Mr. R. M. Piper president, and Mr. Wright secretary.

The specific charges against President Humphrey were that while acting for the company in the sale of treasury stock for the purpose of raising money to improve the plant, he employed brokers to purchase stock in the open market on his own account at 50 cents per share and sold the same as treasury stock without accounting to the company.

Mr. Humphrey answering these charges denied that he or his authorized agent had represented to purchasers that the stock sold was treasury stock, or that he had made purchases of outside stock since May, 1907, on his own account after he was elected president of the company, that he did, however, purchase stock for the company in order to clear up the market to facilitate the sale of the company's treasury stock, and that his dealings with the company are shown in the annual statement of the company for 1907 shows that I have paid to the company, net cash, upwards of \$100,000 for the treasury securities of the company, delivered to myself on my order.

The Chicago & Alton Railway Co. has advertised that it will make an extensive use of reinforced concrete railway tiles on the line of its right of way.

The Penn-Allen Cement Company's plant is expected to start up March 16th.

Joseph Homer has been elected as general manager of the Nozault Portland Cement Co. He was formerly with the Bath Portland Cement Co.

An additional force of men is to be employed on the Southern California Portland Cement Company's new plant at Riverside, Cal.

The Sandusky Portland Cement Company's plant at Bay Ridge started up on March 6th. The company's other plants at Syracuse, Ind., and at Dixon, are to follow.

South Bend, Ind.—The Concrete Mfg. Construction Co., of this city, according to reports, will construct and equip a plant on 5 acres of gravel land for the manufacture of stone by a new process from cement, gravel, water and other ingredients, the same being perfected and shaped up in a machine with a pressure of 100,000 pounds to the inch.

At a meeting of the directors of the British American Portland Cement company at Kansas City Friday, T. J. Coughlin of Topeka, Kansas, was elected general manager of the company. The company is building a cement plant at Nowata, Okla. Mr. Coughlin will have full charge of the work.

Ogden, Utah, March 4.—The Union Portland Cement company of this city has resumed operations and is now turning out about 2,000 barrels of cement daily.

The Buckhorn Portland Cement Co. of Manheim, W. Va., has gone into the hands of a receiver. Robert W. Patton of Philadelphia being the receiver of the U. S. District Court sitting at Trenton, N. J. This is the third or fourth time this company has been closed down and sold out by the courts.

A deed of trust for \$200,000 was filed in Independence yesterday by the Kansas City Portland Cement company in favor of Commerce Trust company of Kansas City, as trustee. The deed of trust is to secure the payment of first mortgage

bonds issued by the company, and is placed upon the plant at Wayne City, north of Independence. The plant was put into operation about a year ago.

INTERNATIONAL CEMENT CO.

At a meeting of the board of directors of the International Portland Cement company held in the offices of the company, Hope Building, Ottawa, Canada, on Feb. 26, the question of doubling the capacity of the present works of the company was discussed.

So great has been the demand for high class cement that the necessity for still further increasing the capacity of the plant has forced itself upon the notice of both directors and shareholders, and has been discussed at several previous meetings.

The plant last year was increased by about one-third, giving it a capacity of about 2,600 barrels per day for the coming season, but this is said to be not nearly sufficient to meet the growing demands for the product.

When interviewed after the meeting, the managing director of the company, Mr. J. S. Irvin, stated that he had nothing to say for publication other than that the directors are seriously considering plans for duplicating the International works in order to meet the increased demand.

The sale of the Great Northern Portland Cement Co., has been postponed to April 3rd in order to permit the bondholders and owners of the company's stock to come together and formulate a plan to reorganize. The following scheme has been suggested:

The bonds of the old company are to be taken up by the new issue of \$600,000 second mortgage 7 per cent gold bonds. The stock issue is to be \$1,000,000, of which \$400,000 is to be distributed to subscribers to the new and holders of the old bonds, \$200,000 to each class. The remaining \$600,000 is to be distributed among the stockholders and creditors of the old company.

Bondholders' and stockholders' committees say this is the only plan they can evolve that will save the plant from foreclosure and loss to present stock and bondholders.

A special train provided by the Universal Portland Cement Co. of Pittsburg and Chicago, with 75 civil engineers, contractors and builders, left Milwaukee over the Milwaukee & St. Paul R'y on the morning of March 10th for the Universal Portland Cement company's plant at

Buffington, Ind., where the day was spent in looking over the plant. Mr. B. F. Affleck, the company's Gen. Sales Agent, was in charge of the excursion.

THE CONCRETE INSTITUTE.

One hundred members have been enrolled in England in an association which is to be known as The Concrete Institute. The first meeting is to be held in March, the object being to advance concrete and concrete steel research work in England.

ARTIFICIAL MARBLE AND LIME STONE.

Reconstructed lime stone and marble is now being manufactured by the Lithographic Stone and Marble Co. of No. 11 Finsbury Square, London, England. The stone manufactured under this new process contains only the component parts of the natural stones. The crushing strength of the reconstructed run as high as 13,124 pounds per sq. inch, the average crushing strengths of over 2,500 tests being 11,829 pounds per square inch, the crushing strength of Aberdeen granite being 8,000 pounds per square inch. Blocks and slabs are produced without flaws or other defects from chips of natural stone; the process consists in liberating the gas, which is liquified and stored in tubes and reused in mixing the lime and fine powder, and subjecting the material to hydraulic pressure, in plain or ornamental molds, the product being equal to the best natural stone.

The White Portland Cement made by the Sandusky Portland Cement Co., Sandusky, O., has been specified for the exterior finish of the Southern Pacific Hospital at San Francisco, also the interior finish and for pointing the stone work on the new bank building at San Jose, Cal., and for swimming pool in mosaic work at Atlantic City, N. J.

The Sandusky Portland Cement Co., Sandusky, O., manufacturers of Medusa Water-proof Compound report it specified by the Bureau of American Republics. This is one of the highest compliments that can be paid to the quality of any product.

The material has recently been used successfully in the following work:—Concrete water tanks Gloekler Bldg., Pittsburg, Pa.; basement walls Joplin Hotel, Joplin, Mo.; Third National Bank Bldg., St. Louis, Mo.; U. S. Navy Yard Puget Sound, Wash.; Lynn Haven Hotel,

Norfolk, Va.; Cleveland Concrete Building Block Co., Cleveland, O., in their entire output; Oregon Short Line Construction, Salt Lake, Utah; Oswego Falls Paper Co., Fulton, N. Y.; G. & T. Earle Co., contracts, Wilmington, England; Armour & Co., construction, Chicago, Ill.

Lieut.-Col. H. F. Hodges, General Purchasing Office, Washington, D. C., has postponed the date for opening bids for 4,500,000 barrels of Portland cement for the Isthmian Canal Commission (Panama Canal) to April 13th. The bids were to have been opened on March 12th, but an account of legislation pending in Congress covering Panama Canal supplies the date was changed as above noted.

The Ironton Portland Cement Co. on March 2nd elected the following officers: S. B. Steece, president; F. C. Tomlinson, vice president; J. R. Paul, secretary; and A. C. Steece, treasurer and general manager. These are the same officers who served the company last year.

The Southern California Portland Cement Co., which has a plant under construction near Riverside California, has received 25 carloads of machinery during the past month. The working force is gradually being increased.

The Dakota Portland Cement Co. of Chamberlain, S. Dakota, has been chartered. The final reports of the company's experts dealing with the raw materials are about completed. A site for the plant has been selected, covering one hundred acres on the Chicago & Milwaukee & St. Paul Ry. at Chamberlain, S. Dak. D. B. Zimmer and associates are at the head of the enterprise.

A new Portland Cement Co. is to build a cement plant in Gallatin Co., Montana, on the line of the Northern Pacific Railway about half way between Helena and Butte. A town site has been laid out to be known as Trident. Mr. Osborn B. Gibson of Ogden, Utah, is Ass't. Gen. Manager in charge of the preliminary work. Reed Smoot, U. S. senator from Utah, is one of the stockholders. We understand the company will take the name of Rocky Mountain Cement Co. and be under practically the same management as the Union Portland Cement Company of Ogden which now operates a plant at Devil's Slide, Utah. The company has an office at 904 Rector Building, Chicago, Ill.

J. M. Edwards, of Lewiston, Idaho, is the prime mover in the West Coast Portland Cement Company, whose headquarters are at Seattle, Wash. The company's holdings are just above the mouth of the Grand Ronde river, partly in Washington and partly on the Idaho side of the Snake river, where a cement plant with a capacity of 1,000 barrels daily will be erected. Ground has already been broken.

F. H. Lewis, of Staunton, Va., is the consulting engineer for the Maryland Portland Cement Company, now erecting a 2,500-barrel plant at Hagerstown, Md. Mr. Lewis also planned and erected the plant of the Standard Portland Cement Company, at Leeds, Ala., which has been running satisfactorily since its start. The officers of the company are DeCourcy W. Thom, president and treasurer, and Loring A. Cover, secretary, with offices in the Equitable Building, Baltimore, Md.

The Yellowstone Portland Cement Company will erect a 6,000-barrel cement plant at Gardiner, Mont. It will cost \$1,350,000 when completed, and will be operated by electricity.

Chas. Wohlrabe, of Truman, Minn., has received machinery for a cement tile building block manufacturing plant which he will erect on his farm shortly.

The Isthmian Canal Commission has awarded a contract for 4,000,000 barrels of cement to be used in constructing locks and dams for the canal.

Messrs. Chris. Nelson and D. E. Wilson, of Evansville, Minn., propose the establishing of a cement block factory there next spring.

The Northwestern States Portland Cement Company, of Mason City, Iowa, made its first cement recently. A second kiln has been started.

The new plant of the International Sugar Feed Company, in Southeast Minneapolis, is a good example of concrete construction.

The Thornton Cement tile factory of Thornton, Iowa, is now in active service, having turned out its first tile there recently.

Eugene Teutsch, of Minot, N. D., will erect a cement block factory

this spring at his sand and gravel pit in Brooklyn addition, with a capacity of 1,000 blocks a day. It will be 48x60, and will be equipped with modern machinery and will be operated by electricity.

The E. G. Ingwersen Manufacturing Company, of Clinton, Iowa, amended articles of incorporation to manufacture and deal in cement, brick and stone cement blocks used in construction of sidewalks and buildings, with a capital stock of \$25,000.

The Fort Atkinson Cement Block Company, of Fort Atkinson, Wis., has been organized with a capital of \$15,000. The company will manufacture concrete blocks, cement shingles and tile. Twenty men will be employed by the plant.

At the annual stockholders' meeting of the Union Portland Cement Company, at the company's offices, 318 New York Life building, Kansas City, Mo., held January 14, the following officers and directors were elected:

K. C. Barton, president; R. C. Patterson, first vice president and general manager; A. Henley, second vice president; W. B. Lydenberg, secretary; J. H. Rush, treasurer.

Directors: T. J. Anderson, Gas City, Kan.; Guv C. Barton, Omaha, Neb.; K. C. Barton, Omaha, Neb.; Louis F. Boder, St. Joseph, Mo.; C. S. Jones, Kansas City, Mo.; A. Henley, Lawrence, Kan.; Joab Mulvane, Topeka, Kan.; R. C. Patterson, Kansas City, Mo.; Frank Riddle, Iola, Kan.; J. H. Rush, Kansas City, Mo.; T. P. Sweet, Topeka, Kan.; John Townsend, St. Joseph, Mo.

The company is now securing plans and specifications with a view to immediately letting a contract for the erection of a first-class up-to-date Portland cement mill, of a daily capacity of 3,000 barrels, on its grounds at Iola, Kan.

At the eighth annual election of the Alpena Portland Cement Company, held at Alpena, Mich., January 12, the following officers were elected: President, Herman Besser; vice president, C. H. McKim; secretary, C. H. Reynolds; treasurer, W. H. Johnson; auditor, F. W. Fletcher. Directors: Frank W. Gilchrist, F. W. Fletcher, P. Culligan, J. H. Cobb, Geo. R. Nicholson.

The new plant of the Ash Grove Lime and Portland Cement Company, Kansas City, Mo., now under

construction at Chanute, Kans., is being equipped with thoroughly up-to-date machinery, suitable for a large production of cement. There are to be five 125x8 rotary kilns installed and the fuel to be used will be natural gas, of which the company now has a flow of 130,000,000 ft. per day. The power plant from which the entire mill will be operated will be one of the best equipped in the middle West. Four 22'x42' Reynolds' Corliss Engines have been purchased from Allis-Chalmers Company, Milwaukee, through the Hunt Engineering Company, Chicago. These engines will be connected by rope drive to line shafts operating the cement making machinery.

This Company, which has been established for a good many years, will turn out from the new plant a high grade of Portland Cement for which it has found a good market in the immediate vicinity.

THE BUYERS' CLUB BUILDING.

A new type of business building is under way in St. Louis which presents many practical features never before carried out on such a large scale, and others of perhaps equal value which have never been utilized anywhere before.

It is to be called the "Buyers' Club Building," and its cost, it is estimated, will be fully \$4,000,000. Eames & Young of St. Louis are the architects, and the building was promoted and will be financed by H. A. Vrooman, President of the State Trust Company, of St. Louis, who has erected some of the largest apartment houses in that city. The Buyers' Club Building will occupy the entire block bounded by 17th, 18th, Chestnut and Pine streets, a location within one block of the St. Louis Station, and a suitable one for all visitors to the city.

Its ground area is 234 by 324 feet, and it will be eighteen stories high, with a tower extending ten stories above the building. It will be given up entirely to the display of merchandise with the exception of the top floor, which is to be sumptuously furnished for club purposes exclusively for visiting buyers, convention delegates, etc., and the tower, which will contain offices. The club floor will comprise a convention hall with committee rooms, etc., the use of which will be given free, together with all the club privileges to all visiting buyers and to conventions where the delegates are in a position to buy goods or influence their purchase.

The first floor will be devoted to

general display, demonstration and advertising purposes. The basement to demonstrating machinery, engines, tools, etc., with provision for power of every nature. Sixteen floors will be used exclusively for sample rooms.

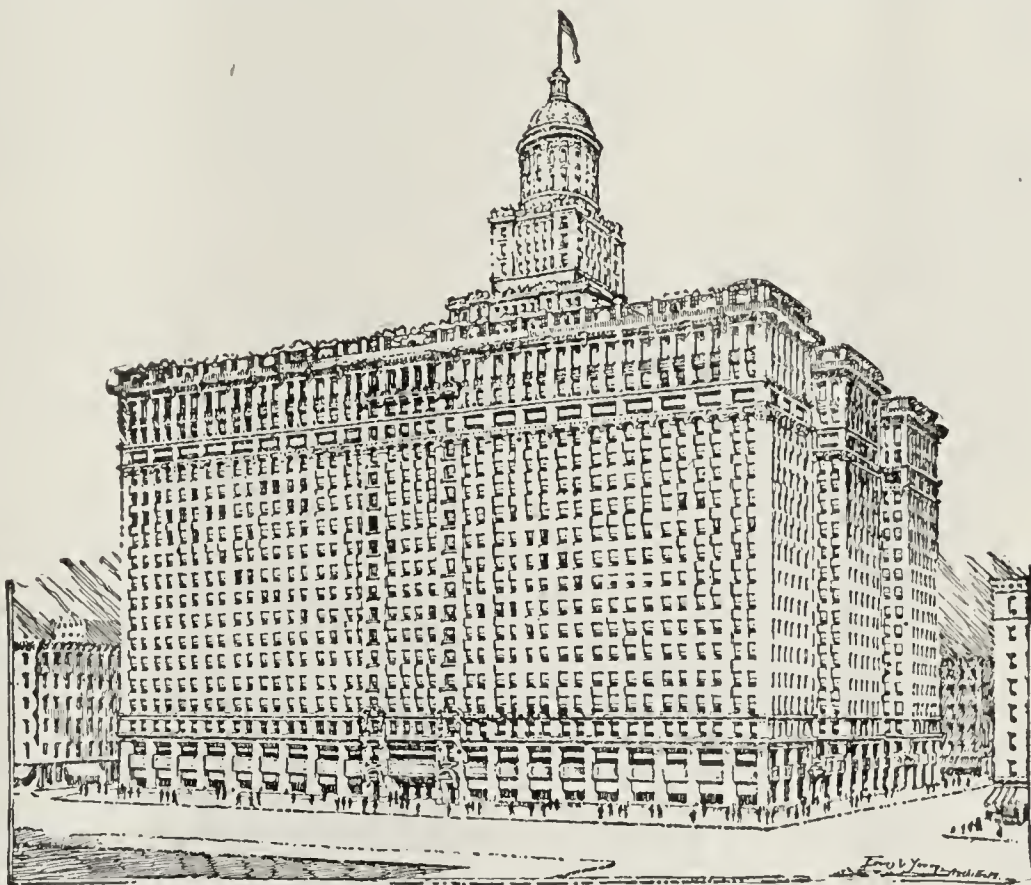
The most important feature the Buyers' Club presents is the plan for bringing the buyer to the seller. The fare of 10,000 buyers will be paid to St. Louis annually by the building company, and the exhibitors will choose the buyers who are to be brought. Special trains will be hired by the company and run from distant points where dealers from a considerable radius can be gathered. The building is designed to extend the territory St. Louis supplies, so that exhibitors will enjoy not only the immense trade of the southwest which now centers in St. Louis, but

mosaics. All interior doors and trims as well as window trims will be of steel and copper so that no fire could spread from one room to another nor to the corridors. Elevators and stairs will be protected by enclosures of metal and wire glass, making impossible the spread of smoke.

Ten large passenger elevators of the highest type of efficiency are provided, and two freight elevators with special lifting capacity for hoisting machinery, safes, etc. Toilet rooms will be mechanically ventilated by exhaust fans.

THE PAULSEN WIRELESS TELEPHONE.

Mr. Paulsen, a Danish inventor, promises to introduce a system of wireless telephony in the near fu-



Buyers' Building, St. Louis, Mo.

that of all the central west and northwest as well. Only a limited amount of space will be leased to each exhibitor so that the exhibits may be sufficiently comprehensive to attract the best classes of buyers from great distance.

A club Bulletin will be published monthly and sent to over 100,000 retail buyers. A close organization of all the retailers in the central and southern states will be promoted by the Club Management and extensive plans for the benefit of the various retailers are under way.

The Buyers' Club Building will be thoroughly fireproof with an interior finish equal to the best office buildings. The floors throughout will be of finished fireproof composition with floors of corridors and public places laid in marble, tile and

ture which is to transmit speech from Europe to America. Paulsen's device consists of talking into a Nerst glow lamp, through a speaking tube or telephone transmitter. The vibrations or radiations issuing from the Nerst lamp are continuous, and may be compared to waves produced when a stone is thrown into a body of water. In the same way the ether which fills all space is excited by the vibrations set up in the glow lamp, and are modified by the human voice so as to transmit speech which, when intercepted by a suitable receiving instrument at distant points, the spoken words reappear or are given up by the ether to a receiving instrument. The trouble at present with the Paulsen wireless system is to devise a receiving in-

strument of sufficient delicacy to intercept the original vibrations set up in the ether at the transmitting station, since these vibrations excite the ether on all sides. To reach New York from Denmark, a distance of nearly 3,000 miles would be traversed, the same vibrations would at one and the same time spread over Europe, and beyond, the energy of the vibrations excited at the instrument becomes so feeble as not to be able to excite the ordinary receiving instrument. The Paulsen idea is not a new one, the electric arc has been used to supply continuous electric oscillations for transmitting speech as early as 1883, when the electric arc was made to speak. This mode of transmitting speech is known as the Themo-phone system, which is based upon the same general principles as light and heat is transmitted from the sun to the earth in continuous waves. Almost any incandescent body, when connected with an electric current, will answer for the transmission of speech.

CONSUMPTION OF POLES IN 1906.

The United States Forest Service has compiled statistics covering the number and value of wooden poles used in the United States in 1906, by 6,000 companies operating telegraph and telephone lines, electric light and power systems, trolley used at \$9,471,171 at the point of purchase. Cedar and chestnut supplied nine-tenths of all the poles furnished, as follows: Cedar, 2,174,-

279; chestnut, 988,084; pine, 177,809; cypress, 111,657; all other kinds, 122,837. The average value of cedar poles was \$1.57 each; chestnut, \$1.66; pine, \$3.86; cypress, \$2.30. A 40-foot cypress sells at \$4.42, the same length cedar, \$6.17. A sawed post costs more than a round post, and last longer. Poles that have not been treated with preservatives give from 10 to 15 years' service.

and street railway lines, and railway companies which operate their own telegraph and telephone lines. 3,574,666 poles were purchased, val-

The Glens Falls Portland Cement Co. were to resume on March 16th, after a two months shut down for repairs.

Five of the old employes of the Aetna Portland Cement Co., of Fenton, Mich., have gone to the Dewey Portland Cement Co. at Dewey, Oklahoma. E. M. Bunce, superintendent, formerly with the Aetna Cement Co.

The Texas Portland Cement Co. of Dallas, Texas, has been reorganized. It is now a separate and distinct company from the Iola Portland Cement Co.

The Corporation Committee of the Maryland Legislature, has reported favorably on a bill to permit the Electrical Commission of the city of Baltimore to erect concrete poles in alleys and outlying

districts of the city, to be used for street lighting purposes.

The Tulsa Portland Cement Co., of Tulsa, Okla., has been organized with a capital of \$300,000, all subscribed by outside and local capitalists. A plant will be built just west of Tulsa, at Lost City, where an abundance of raw cement material is available.

The following officers were elected at the first meeting of the directors: John O. Mitchell, president; I. E. Sater, of Stillwater, Okla., first vice-president; Robert Galbreath, second vice-president; J. G. McGannon, treasurer; Philip Kates, secretary, all of Tulsa.

Sleeper & Davidson was selected as the general counsel of the company.

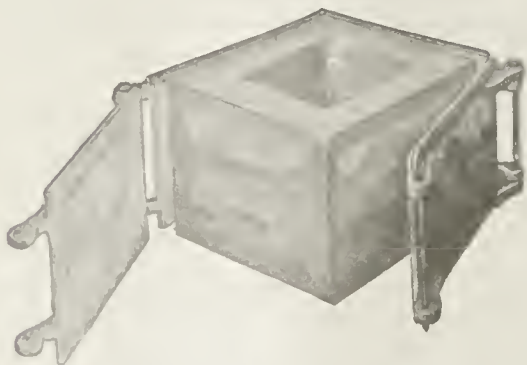
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FOR SALE—Patent No. 850,778 for burning cement. Address A. A. care Cement & Engineering News.

WANTED—A position as chemist by a man with good technical education; three years' experience in the manufacture of Portland cement, dry process. Best references. Address C. N. Y., care Cement & Engineering News.

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Can be used for trolley and telegraph poles with entire satisfaction at the lowest possible cost and the greatest strength.

Our truss consists of a sheet of steel rolled into the form of a tube, and used as a core; each end of the tube carries small plates through which are secured the four truss wires; truss plates are likewise carried on the sheet steel core, and so distributed as to form the best and strongest possible truss by four wires, all as shown in the illustration. The complete truss, 6 1-2 ft. long, weighs 3 lbs. This truss is furnished either assembled or knocked down as preferred. We also furnish mold in which the post is formed. We sell county rights, and supply the reinforcing and molds on close margins. We can substantiate all claims made. Inquiries solicited, agents wanted, send for description. Address

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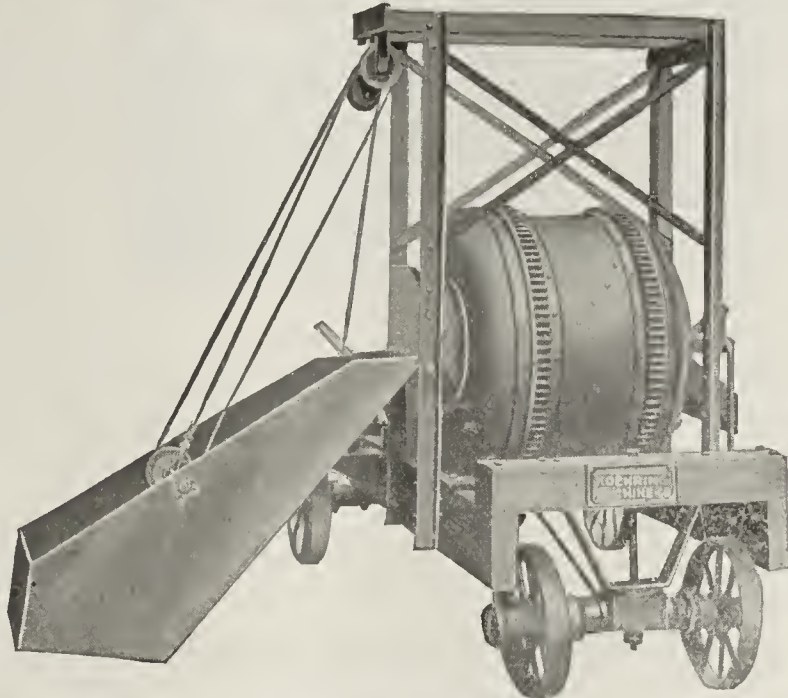
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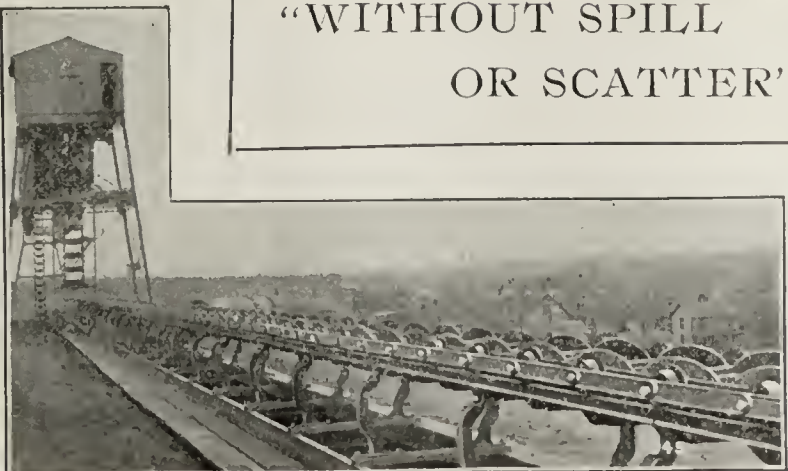
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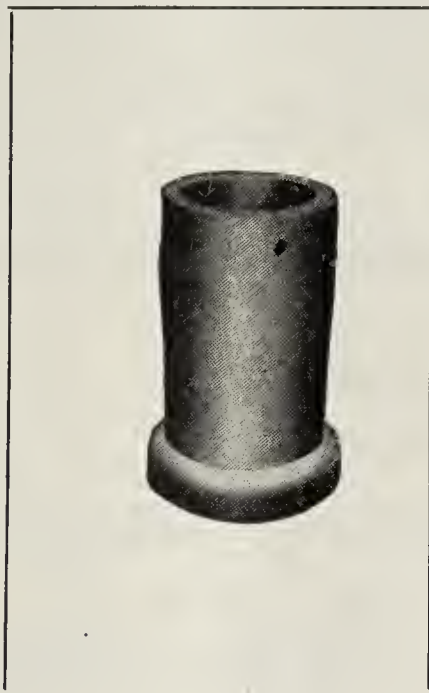
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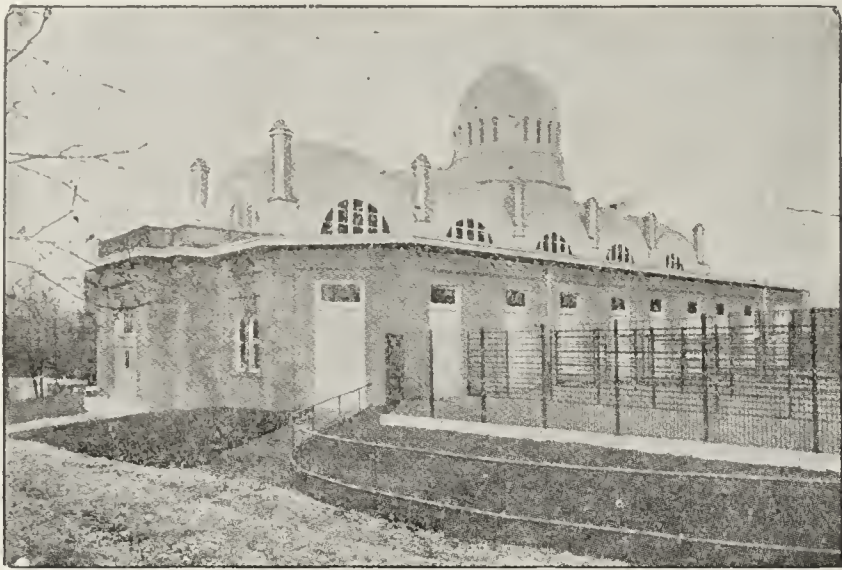
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Exceptionally beautiful and attractive. The outfit is thoroughly practical and makes a splendid porch. Buy one and increase the profits of your business. Hundreds in use. Price for outfit very reasonable. We also manufacture Block Machines ranging in price from \$50 to \$250. Concrete Mixers, Brick Machines, Silo Machines, etc.

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HERCULES POWDER

This Brand is in Great Favor With Quarrymen

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The

HARDENING PROCESS of HYDRAULIC CEMENTS

Describes Process of Manufacturing
Mineral Gel from Portland Cement.

An Entirely New Application.

BY

DR. W. MICHAELIS, Sr.

Price, 50 Cents

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**Cement and Engineering
News**

CHICAGO ... ILL.

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Tube Mill
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CLINKER AND COAL

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Quality unexcelled. The Recognized Standard American Brand. Always Uniform.

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Manufacturers of but one grade—strictly straight Portland.
General Office, EASTON, PA.

When You Build Use Concrete

It is economical, durable, fireproof and sanitary; needs no paint or repairs, is warmer in winter, cooler in summer than any other construction and is adaptable to any type of

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We have prepared for Manufacturer and Merchant a new book dealing solely with the important question of factory building.

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a book containing, besides several general chapters on concrete, concrete aggregates, methods and materials for reinforcing—*ten chapters giving detailed description of ten Concrete Factories and Warehouses* erected in various parts of the country by different systems. The photographs, sectional drawings, and specifications for this book were furnished by the engineers in charge of the work.

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THE ATLAS PORTLAND CEMENT COMPANY

Dept. 3

30 Broad Street, New York

Lightness is the Main Feature, Heaviest Part Only Weighs 160 Lbs.



San Diego, Cal., May 20, 1907.
PARKER HOIST & MACHINE CO.,
Chicago, Ill.

Gentlemen:—The No. 4 Derrick I purchased from you over two years ago has proved very satisfactory. In the building business for 30 years I have used several kinds and makes of Derricks and I consider it the most convenient, economical and up-to-date derrick for light work I have had in that length of time.

Yours very truly,
W. J. KIRKWOOD, 1544 Fifth Street.

Gentlemen:—Your hand power Derrick No. 1 arrived O. K. some two months since. I have given it some very severe tests and found it to meet every requirement.

You claim a capacity of 1,500 pounds for it, and the first thing I did with it was to set a corner stone that weighed 2,100 pounds and it handled it nicely.

Very respectfully,
JOHN D. BLEVINS.

New Brunswick, N. J., September 20, 1907.
PARKER HOIST & MACHINE CO.,
971 N. Francisco Ave., Chicago.

Gentlemen:—In regard to the Parker Derrick No. 1 purchased from you some months ago we can say that we have found the derrick to be everything you represent, and we have been more than pleased with it, from the first day we began using it.

The fact that we have recently ordered another of the same kind speaks for itself. Have placed some extremely heavy work the past month and the Parker No. 1 Derrick did the work beautifully.

Our one regret is that we did not run across the Derrick at an earlier date. It would have saved us money.

Yours very truly,
MIDDLESEX HOLLOW CONCRETE BLDG. BLOCK CO.,
Per Mr. J. Dahmer, Treasurer.

We have a catalogue describing these little derricks with a great many more letters as above; better ask for it. No. 1 Derrick will handle 1,500 pounds; No. 4 Derrick will handle 4,000 pounds.

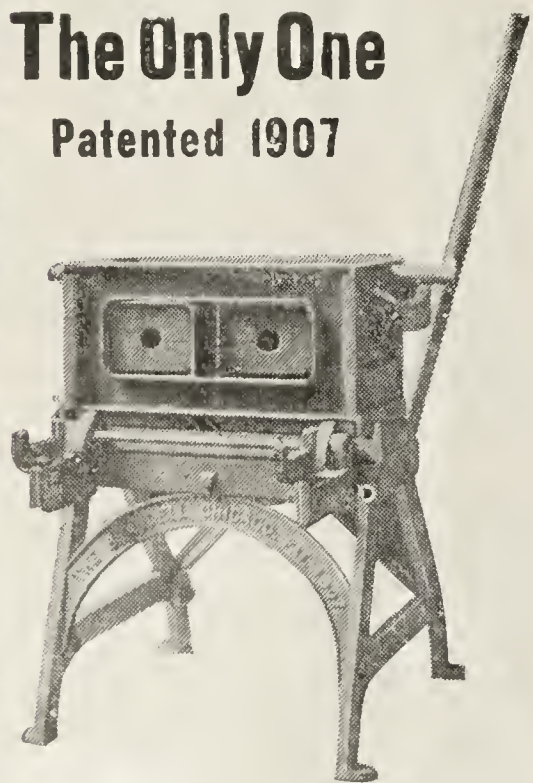
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960 N. Francisco Ave., Chicago, Ill.

The Machine with the Self-Locking Mold.

The Only One

Patented 1907



Do Not Waste Your Efforts

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THE BRANDELL IS A LABOR-SAVER

Due to the Self-Locking Mold, the BRANDELL will turn out blocks—perfect ones—in less time and with fewer motions—that means with less labor—than any other machine can possibly do.

The BRANDELL is a one-man, face-down block machine, reliable, simple, easy to understand and easy to operate.

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130 Dearborn Street

CHICAGO, ILL.

CEMENT

.....AND.....

ENGINEERING NEWS



STONEKOTE PORTLAND EXTERIOR.

Residence of G. T. Burrell, River Forest, Illinois.

A. T. Hawk, Architect, Chicago.

(For description, see page 86.)

CEMENT AND ENGINEERING NEWS

(PUBLISHED MONTHLY)

WILLIAM SEAFERT, Editor and Publisher

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JOHN F. WALDRON, Advertising Manager

CHICAGO, APRIL, 1908.

CORRESPONDENCE.

We solicit correspondence on all matters of general interest to the cement trade in all its branches. Engineering notes, public improvements, and facts and opinions drawn from practical experiments will be welcome.

BUILDING ACTIVITY IN CHICAGO.

All indications point to a prosperous season in the building industry. A larger number of permits were issued by the city building department during the first three months of 1908 than in the previous year. There was a slight decrease in the original value of the 1908 permits, accounted for by the lower prices of materials than in 1907. The reason given for the increase in the issue of building permits is that people are investing in real estate rather than risk a panic which would tie up their cash indefinitely. Bargains in real-estate are being picked up very rapidly for building sites. Again the average 20 per cent. drop in building material and the many mechanics out of employment reduces the cost of building operations. People with idle money are taking advantage of this favorable moment to conduct building operations and in this way place their idle capital where it will not be lost in bank failures. What is true in Chicago is in a great measure true in the large and small towns throughout the West. This is the Presidential election year, when business suffers, and in consideration of the fact that the country has just passed through a severe panic, the outlook is better in reality than could be expected. Cement seems to be favored beyond all other materials of construction at this time. There is considerable depression in other lines of building materials. Lumber dealers say that while there has been a decline of 20 per cent. in the market for lumber, the decrease in price has not stimulated the demand for this commodity.

Common brick which last year sold from \$6 to \$7 per thousand are now quoted at \$4.50 in Chicago and have a slow sale. Crushed stone and gravel are in good demand for cement construction. The several cement exhibitions held in Chicago during the past two years have had a stimulating effect in bringing concrete construction into popular favor in Chicago and throughout the West. Cement manufacturers should encourage these cement shows, especially in the East where the average citizen needs to be educated in the value of cement as a building material.

GET RICH QUICK CEMENT PLANT PROMOTERS.

We reproduce the following from the Administrative Report of the Geological Survey of New Jersey, for 1907.

Portland Cement.—In some of the Western States, notably Michigan, the Portland cement industry has been extolled in highly-colored circulars of the "get-rich-quick" variety, as the means par excellence for acquiring wealth. The Lehigh district comprising eastern Pennsylvania and Warren county, New Jersey, has from the first been the most important Portland cement region in the country. Here the growth of the industry has been most rapid, the production increasing from 201,000 barrels, in 1890, to 22,784,613 barrels in 1906, and the number of mills from 5, in 1890, to 20 in 1906. For the most part the industry in this region, in spite of its marvelous growth in the past decade, has been free from the stock selling companies which have been the curse of the mining industry.

There are indications, however, that this immunity no longer exists, for within the last six months an elaborate and extravagantly-worded circular has reached this office, "promoting" a new Portland cement company near Carpentersville, this State. Much emphasis is laid upon extracts of one of the Survey reports, which are quoted at length, and which relate to the occurrence of cement rock near Carpentersville and its chemical composition. In order that there may be no misapprehension regarding these statements, it is proper here to point out that while there is no question as to the occurrence of cement rock at the locality mentioned, the analysis quoted were not made by the State Geologist, or by any member of the Survey staff, nor were the rock samples which the analyses represent collected by any member of the

Survey, but, as stated in the original report and as quoted in this circular, they were furnished to the Survey by the gentleman who then had an interest in the property. The State Geologist has no reason to question the reliability of these analyses, but he has no actual knowledge regarding their truth.

While there is no disputing the extraordinary growth of the Portland cement business during the past few years, and while it is to be presumed that it has been conducted on the whole at a profit, nevertheless prospective investors should bear in mind some facts which are well recognized by all authorities in this industry.

In the first place, in spite of the enormous expansion in the use of Portland cement and the consumption in this country of 48,154,802¹ barrels in 1906, it is a fact well known to all cement men that the total capacity of the present Portland cement plants is in excess of the present output. This being the case, there is small chance of a new company in the Lehigh region reaching the dividend-paying stage, except after a long and hard struggle against the competition of existing plants, the product of which is well known in the market.

Furthermore, the initial investment required to start a Portland cement plant on a basis to compete profitably with established concerns is large. Apart from the cost of the land, a 2,000-barrel-per-day plant would cost not less than \$500,000² at the lowest estimate, and some reliable authorities set the figure at \$700,000 or more. But the amount of capital required to start properly a cement proposition is much more than the cost of the land and plant. A large reserve working capital is necessary for several reasons. No new cement plant can be expected to produce normal cement at normal cost until after a profitless and expensive period of experimentation. Even after a plant is working normally, ready sales of its product cannot be expected, owing to the well-founded prejudice in favor of old-established brands whose worth has been proved by long experience. Against this prejudice headway can be made but slowly, and then only by superior quality or lower prices until the reliability of the new product is well established.³ Moreover, many of the running expenses of the plant must be paid in cash, while cement is sold on comparatively long time. Including the cost of land, the capital needed to start successfully a

2,000-barrel plant will probably be not far from \$1,000,000.

It is commonly believed that the profits in the Portland cement industry are very large, and this belief is energetically fostered by many so-called "cement engineers," and "cement experts," as well as by irresponsible promoters. For instance, the circular in question promises a "clean profit of 60 cents on each barrel manufactured" and asserts that "this big margin of profit should be just as sure in this company as a 4 per cent. in a bank or trust company or a 7 per cent. Pennsylvania railroad stock." The actual facts seem to be, on the contrary, that there is not now, and has not been for a number of years a large margin of profit for most of the plants now engaged in Portland cement manufacture.

According to some authorities,⁴ the cost of manufacture in the Lehigh district (which embraces also Warren county, N. J.), in a 2,000-barrel-per-day plant, ranges from 77 $\frac{3}{4}$ cents to 68 cents per barrel, exclusive of the package, according to the size and number of kilns, while in the smaller plants the cost is somewhat higher. These published figures are somewhat lower than similar data obtained directly from cement manufacturers of New Jersey and Pennsylvania, and on file in this office. These show costs between 80 and 90 cents per barrel when all fixed charges, such as interest on the plant, depreciation, etc., have been allowed for, but they do not include the cost of the package in which the cement is shipped.

During the past three or four years, the selling price of cement has varied considerably. A careful distinction must be made between the price in bulk and the price including the package. The average cost of the package is 35 cents for a barrel, 40 cents (per barrel) for cloth bags, and 15 cents (per barrel) for paper bags. This cost is charged to the purchaser with a rebate of about 75 per cent. for the return of the barrel or cloth bags in good condition. Since the cost of these packages is not included in the cost of manufacture as given above, it must therefore be deducted from the selling price in order to arrive at a true determination of the margin of profit.

The following table shows the production, total value, and the selling value per barrel of Portland cement in bulk, at the factory, in Pennsylvania and New Jersey, during 1904, 1905 and 1906, as reported by the United States Geological Survey:⁵

PENNSYLVANIA.			
	1904.	1905.	1906.
Amount in barrels.	11,496,099	13,813,487	18,645,015
Total val. \$	\$8,969,206	\$11,195,940	\$18,598,439
Value per barrel..	78 cents	81 cents	99 cents
NEW JERSEY.			
	1904.	1905.	1906.
Amount in barrels.	2,799,419	3,654,777	4,423,648
Total val. \$	\$2,099,564	\$2,775,768	\$4,445,364
Value per barrel..	75 cents	76 cents	\$1.00 $\frac{1}{2}$

The present selling price⁶ (November, 1907) at the mill is from 85 to 95 cents, although some sales have been made at lower figures. A comparison of these figures with the average cost per barrel is evidence at once that the margin of profit is close. Whenever the net selling price of cement (exclusive of the package, freight, etc.) reaches 80 cents per barrel at the mill, some of the mills of the Lehigh district sell at an actual loss, and the average dividends paid by one of the most successful plants since its establishment are reported not to have exceeded 6 per cent. of the capital stock. During 1904 and 1905 the margin of profit of one large mill was only a few cents per barrel, with nothing allowed for the depreciation of the plant. It can be accepted as certain, therefore, that all claims of net profits of "60 cents per barrel" for Portland cement are grossly exaggerated, if not willfully fraudulent.

There have been several editions of the prospectus in question. In the earlier ones, 10,000 shares of stock are offered the public at \$5 per share (\$6 time payments), and the statement is made that "this is the original ground floor offering." However, it appears in a later edition that the stock is offered at \$7.50 per share, and prospective purchasers are again assured that this later advanced price "is the original ground floor offering."

If further comment were necessary, ground for it might be found in the statement: "The property has a frontage of six hundred and fifty feet on the Delaware river, so that the product can be shipped to Philadelphia and to the seaboard by water."

To one familiar with the Delaware river between Trenton and Carpentersville, and the dams at Scudder's Falls and Lambertville, to say nothing of rock reefs and rapids at other points, the misleading effect of such a statement is apparent, and it casts suspicion at once upon the motives of those who make it. To the prospective investor in some distant state ignorant of these facts it appeals with

force as evidence of a cheap water route which will give the company a marked advantage over its competitors.

It is extremely desirable that all the available cement land of the state should be developed and utilized by the establishment of successful plants. Misleading statements regarding the fundamental facts can only hamper this development.

¹The Cement Industry of the United States in 1906, p. 34, U. S. Geological Survey.

²Eckel, Cements, Limes and Plasters, p. 556.

³The specifications used by the engineer corps of the U. S. army under date of 1902, provide that "no cement will be allowed to be used except established brands of high-grade Portland cement which have been made by the same mill and in successful use under similar climatic conditions to those of the proposed work for at least three years." (Eckel loc. cit., p. 617.)

⁴Boileau & Lyon, Municipal Engineering, Vol. 26, p. 394, June, 1904; Eckel, Cement, Limes and Plasters, p. 561.

⁵Mineral Resources of the United States—The Cement Industry in the United States in 1906, p. 17. The value per barrel was not given in the U. S. G. S. tables, but was computed by dividing the total value by the total product.

⁶In December the price had further declined to 75 to 85 cents per barrel net.

LARGEST CONTRACT EVER AWARDED FOR STEEL SHEET PILING.

Bids were opened recently, at Buffalo by Lieut. Col. W. L. Fisk, United States engineer, for the construction of the walls for the proposed ship lock in Black Rock harbor, Buffalo. The government estimate of the cost of the work was \$1,100,000. The contract will undoubtedly be awarded to McArthur Bros. Co., New York City and Chicago, its bid being \$822,302.85 with steel used for quoins, and \$823,304.45 with granite used for quoins. The contract for steel sheet piling calls for 6,910 tons and is the largest contract ever awarded for sheet piling. The proposals of the six bidders show a wide diversity. The accompanying table gives an abstract of the proposals, except for the following, on which the bids of the McArthur Bros. Co., were:

Clay filling, 45 cents per cubic yard, clay banking, 35 cents per cubic yard; pumping and maintenance, \$8,000; excavation 19 cents per cubic yard; handling material by derrick, bucket measure, 40 cents per cubic yard; dredging channel, scow measure, 16 cents per cubic yard; concrete 74,000 cubic yards, \$4.37 per cubic yard; mooring posts, \$40 each; mooring cleats, \$25 each.

Bids for pumping and maintenance ranged from \$50,000 to \$8,000, and the bids on concrete from \$7.31 to \$4.37.

With good luck and no extraordinary delays at Washington, it is expected that the ship canal lock will be ready when the work of deepening and widening the Black Rock harbor has reached that point.

Locally, the whole project is known as the Niagara ship canal, and it involves carving a canal 23 feet deep and 200 feet wide at its narrowest point through the flint rock bottom from the Erie basin to just below Squaw island.

Work on the canal has now progressed to a point off the new waterworks tunnel at the foot of Porter avenue. The other section, which involves removing the wall between the Erie canal and the harbor for a long distance, has not been let. The federal government's lock will be at the end of this section.

To meet the drop of six feet in the river bed between its head and Squaw island, the government will build the new lock, which will be just below the old small one built by the state. The new one will take the largest ore carriers on the great lakes and lock them down six feet and out into the river proper, so that they can proceed on to Tonawanda. Only vessels of limited size and displacement can go down the river to Tonawanda now.

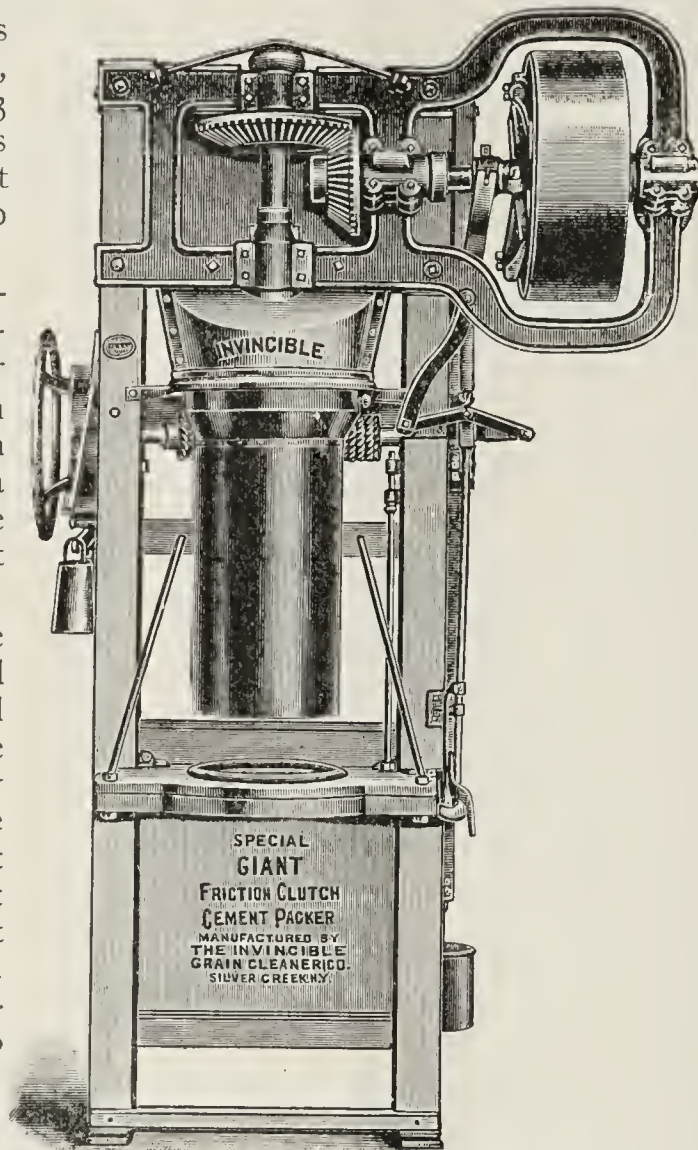
THE INVINCIBLE GIANT CEMENT PACKER.

We present below a cut of the invincible giant cement packer, manufactured by the Invincible Grain Cleaner Company of Silver Creek, N. Y.

This packer is considered to be the fastest and best on the market and is made in three styles, suitable for cement or lime. To meet the demand for a special heavy cement packer this company is now making a new machine which will pack barrels or sacks or both. This has a very large heavy clutch, steel gears and extra heavy bearings.

All of their packers are equipped with their own design friction clutch which is the strongest made and when properly adjusted never slips and quickly releases itself. No cement plant is complete without one of these packers. They are now being used in most of the largest plants in the country including Western States at Independence, Kan., Northwestern States at Mason City, Ia., Southern States at Rock-

mart, Ga., Southern California at Riverside, Cal., Sandusky at Syracuse, Ind., Sandusky at Dixon, Ill., Alberts Manufacturing Co., at Hillsborough, N. B., Art Cement Co., at Kimmel, Ind., Vulcanite, at Vulcanite, N. J., Kosmos, at Kosmosdale, Ky., Penn-Allen, at Penn-Allen, Pa., and J. B. King & Co. at New Brighton, S. I., N. Y.



Invincible Giant Cement Packer.

The Beaver Land and Irrigation Co., of Colorado Springs, Col., operating in the Florence and Canon City district, proposes to invest \$500,000 in the construction of a large reservoir and distributing ditches to be constructed of Portland cement concrete. Where simple earth ditches are used the loss of water ranges from 20 to 60 per cent. While cement ditches are more expensive to construct, they are in the long run the most economical, since they call for no repairs and save the water, which is a great item, especially in the dry season.

CONCRETE FOR ALLEYS.

Concrete such as is used for sidewalk construction is to be tried in Moline, as a substitute for brick in the pavements of alleys as the result of a visit of inspection made to Richmond, Ind., by Clark Anderson, city engineer. In that city almost all of the downtown alleys are so paved, as is also one block of one of the most used streets. Results have been excellent.

STONEKOTE.

Stonekote is the trade name for a preparation of pure Portland cement and white quartz sand, which is being very extensively used as an outside wall coating, possessing all of the valuable properties of Portland cement mortar, such as strength and durability. It therefore finds favor with architects and builders, especially where either elaborate decoration or color schemes are to be carried out in buildings designed to meet the exacting artistic taste of clients. Mortars, as a rule, carrying an admixture of lime, bleach out the color, whereas colors remain permanent in Stonekote, which is absolutely necessary for first-class work. Stonekote is furnished for either float surface or rough cast in the following ready mixed colors: Pure white, cream, dark cream, buffs or in natural cement color. Old houses can be lathed on the outside and covered with Stonekote, where wooden lath is used, the lath must be wet on both sides before putting on the scratch coat. The following instructions to the mechanic in the use of this material are important:

"Stonekote" Portland exterior is a material that works different from any that you have ever used. It is plastic Portland and will spread on metal or wood lath. Because it is plastic do not think you are doing yourself or the owner a good turn by using just as little as you can to cover. One hundred pounds of "Stonekote" scratch coat should be spread on every two and one-half yards. One hundred pounds of "Stonekote" second coat should fill out two and one-half yards to three-quarter-inch grounds on metal lath, or one-inch grounds on wood lath. The scratch coat should be mixed in the box until it is in good shape to spread, and should be used just as soft as you can make it stay on metal lath without dropping down behind the lath, broom this coat as soon as it is on, the next day have the first spread over of the second coat very soft (the scratch coat will not be hard in twenty-four hours, this being all the better for it and the work). Fill out to the grounds with the second coat material, darby and trowel down the surface, and as soon as you can, float with a clean, damp wooden float, being careful to leave a perfectly true, even face where it is to be left as a float surface; where rough cast is to follow it need not be so very particular. But be certain to float it. The best rough casting is done with just enough material to cover all surface and show an even rough-

ness. For figuring material where you expect to have solid thick work, calculate on 150 pounds of material for one cubic foot of stone. This makes 12 1-2 pounds for one square foot, one inch in thickness. Never let two rough casters work on the same panel, or on the same side of the building. Let one man do all the rough casting where it is a practical matter to do so. You will never have trouble in applying scratch coat material on soffits and ceilings where the metal lath is drawn up tight so that wire sings when struck. Where the wire lath is of small mesh, the second coat material, without hair, will often work best for scratching.

Our illustration on the front page is a good example of Stonekote finish for dwelling houses.

This building was erected at River Forest, Ill., for G. T. Burrell, after plans by A. T. Hawk, architect, of Chicago. The exterior, including columns, is in Stonekote natural color, rough cast finish. The material is furnished by the Garden City Sand Co., of Chicago. Stonekote is sold by the ton at \$10.00 for scratch coat and second coat. For floating or troweling, packed in ten jute sacks per ton.

Rough coat \$15.00 per ton; polished trowel surface \$15.00 per ton, and \$25.00 per ton for white Portland, all in 20 jute sacks. For colors, buffs, reds and browns, \$2.00 per ton extra. For white Portland cement \$4.00 per ton extra, and for delicate colors of white Portland \$6.00 per ton extra. For a regular list of dealers write to the Garden City Sand Co., 188 Madison street, Chicago, Ill.

A POWER TAMPING CONCRETE BRICK MACHINE.

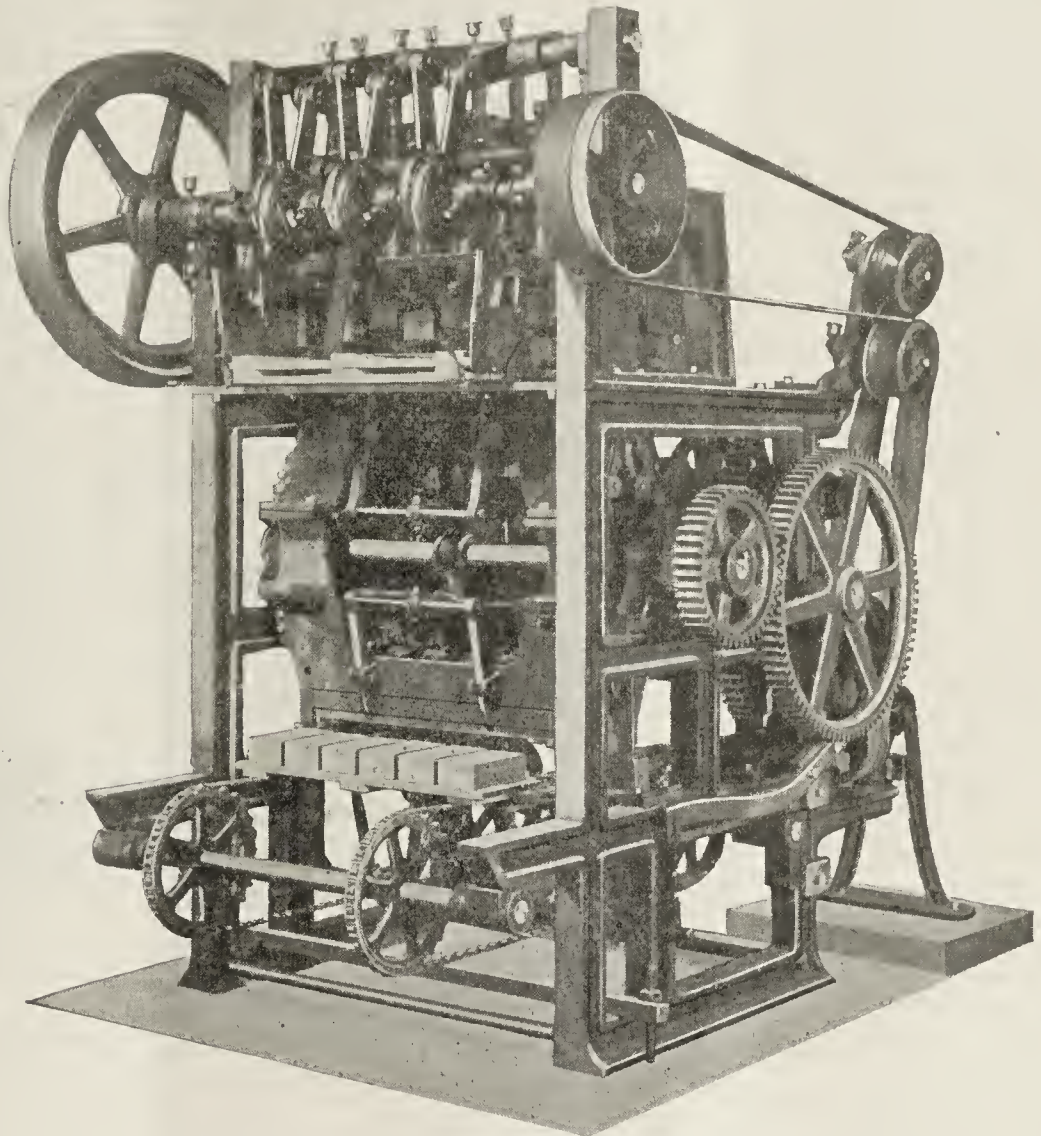
The Fred C. Hohn concrete brick machine has been in process of development for several years and has now demonstrated its practicability and value so that it is ready for market with evidence of what it can do.

The accompanying cut shows the machine without accessories. The concrete goes through the machine in the following order:

A continuous concrete mixer is set on the floor by the side of the machine and drops the mixture ready for putting into brick form on an elevating conveyor which in turn drops it into the feed box of the machine. This much of the apparatus is not shown in the cut.

The six tampers are shown at the top of the machine. On the platform in front of the tampers will be seen a couple of pallets for the removal of bricks from the machine. Beneath the platform is the revolving frame carrying two sets of brick molds, each making six bricks. As this frame revolves a set of molds is filled with the mixture just before it reaches the top of the circle of revolution. It then passes under the tampers and the cement

receives its compression. One of the pallets is automatically drawn from the platform and placed over the set of bricks. The frame then revolves and the set of bricks reaches the bottom of the circle or revolution. The bricks then rest on the pallet and the mold opens enough to let them out safely, by means of the cams and rods seen in the view. The pallet rests on the double chain conveyor shown at the bottom and is carried forward to the position in



Power Tamping Concrete Brick Machine.

IMPORTS OF CEMENT INTO THE UNITED STATES.

WHERE FROM	FEBRUARY				EIGHT MONTHS ENDING FEBRUARY			
	1907		1908		1907		1908	
	Quantity in lbs.	Value in Dollars.	Quantity in lbs.	Value in Dollars.	Quantity in lbs.	Value in Dollars.	Quantity in lbs.	Value in Dollars.
United Kingdom . .	24,450,600	\$79,745	16,709,542	\$58,877	193,098,864	\$621,754	148,891,767	\$539,492
Belgium	30,270,610	87,047	10,119,808	34,908	247,917,081	774,098	111,657,563	351,306
France	376,000	1,478	565,500	1,936	12,167,518	46,801	9,826,227	38,145
Germany	67,662,301	208,219	32,773,290	109,868	336,530,999	1,053,715	196,654,888	651,842
All Other Europe . .	200	2	10,318	79	20,097,670	57,829	3,850,400	13,288
British North Am. .	200	2	1,000	9	3,103,883	22,660	275,740	1,624
Other Countries . .	251,530	1,134	12,800	89	54,278,337	256,109	5,507,533	29,126
TOTAL	123,011,241	377,625	60,192,258	199,776	867,194,352	2,332,966	476,664,118	1,624,823
Domestic Exports of Cement, bbls. . . .	60,848	93,223	67,060	98,279	432,527	719,052	617,523	962,328

There were 19,870,528 lbs. of imported Roman and Portland Cement, etc., in the United States bonded warehouses in February, 1907, valued at \$57,500, against 16,097,951 lbs. in February, 1908, valued at \$46,639.

For eight months ending in Feb., 1907, there were 65,194 tons of asphaltum imported in the United States valued at \$266,430, against 88,259 tons imported in eight months ending Feb., 1908, valued at \$342,205.

which the bricks are seen in the view, from which they are removed by hand and placed in racks on a car conveniently placed. The two sets of molds are placed opposite each other on the revolving frame so that one set is being filled and tamped at the time that the other is emptying itself.

The whole operation is automatic and continuous, no hand labor being required regularly from the time the concrete materials are put in the mixer feed boxes until the bricks are ready to remove from the machine, except the placing of the pile of pallets on the platform. Nine men on the machine feeding materials, removing and storing brick, keeping the machine in order and curing the brick can make 20,000 bricks in ten hours according to the claims of the inventor, and the machine requires ten horse-power to operate. This means a little less than three revolutions a minute of the frame carrying the molds.

In addition to the engine, mixer and brick machine the outfit requires pallets enough for, say, 30,000 brick, cars enough to carry about $1\frac{1}{2}$ days' product and storage and curing capacity for the curing time adopted. The completed bricks are left on the cars on their pallets for 24 hours, when they can be passed on to curing and storage in piles, and this determines the number of cars and pallets required for full operation of the machine.

A. J. Ralph & Co., the general sales agents for the United States, report that much interest is shown in the machine and several sales have already been made, although they have scarcely begun their advertising campaign. They will give full information about cost of outfit, product that can be turned out and probable cost of operation. Their office is at 327 Board of Trade Building, Indianapolis, Ind. Write for their circular "B."

CEMENT TOMB STONES.

Portland cement concrete is conceded to be one of the most durable materials of construction known to man. It resists the action of the elements and the ravages of time. Julius Caesar, when he invaded England, built public roads and water works of concrete, which are still to be seen, and in some cases in actual use at the present time. The cement used was greatly inferior to the cement used today, yet these monuments to Caesar testify to the lasting qualities of even inferior cements. Portland cement concrete



No. 1. Obelisk.

84 inch high. 36x36 inch base.

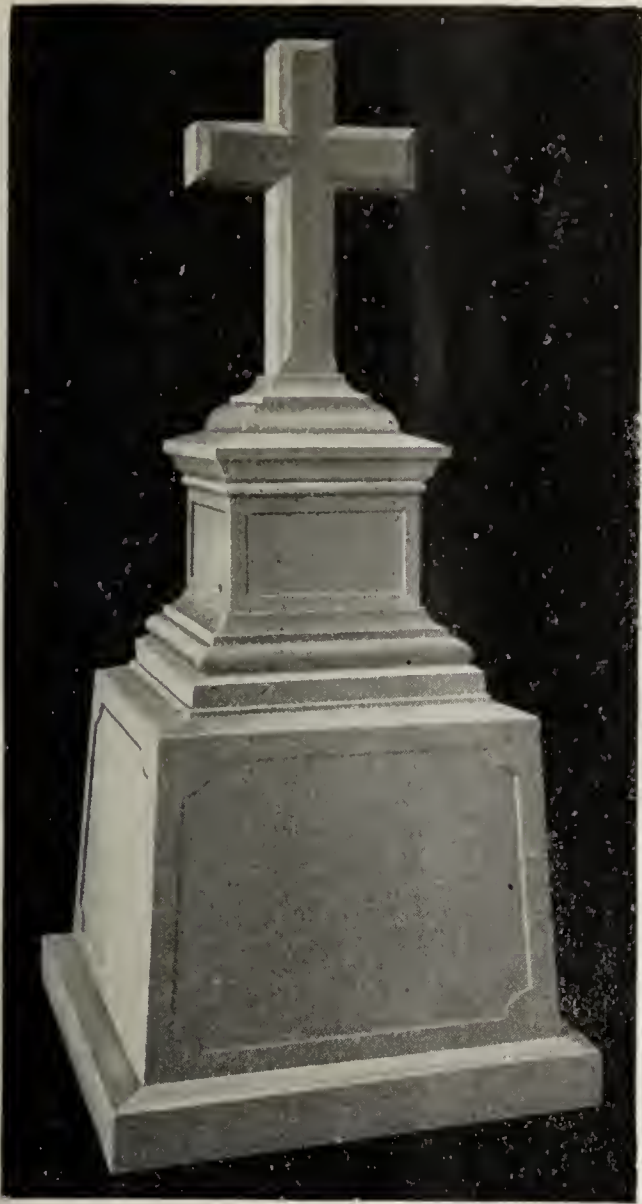
is therefore eminently suitable for molding into tomb stones and monuments. We are glad to note that a very high grade set of molds for tomb stones are now to be had at a reasonable cost, from which various beautiful designs can be reproduced at a moderate cost to meet the requirements of all classes of trade at a good round profit; in fact, there is more money in this class of cement ware than in any other line, as will be seen from the following scale of prices. Fig. 1 is an obelisk, which in cut stone, cost \$150.00. Can be produced in concrete at \$6.00, and sells for from \$50.00 to \$60.00. While Fig. 2, in cut stone, sells for \$150.00. Cost in concrete \$6.00, and sells for \$60.00. Fig. 3, a head stone and cross, will bring \$120.00. Can be produced in concrete at \$5.00, and sells for \$50.00. Fig. 4, a low head stone.

Price in stone, \$75.00. Can be made in concrete for \$2.50, and sells for \$25.00. Fig. 5 is a low head stone, valued at \$75.00 in stone, which can be made in concrete for \$2.50, and sells for \$25.00. These molds are all designed by a first-class sculptor, who has had the honor of having several presidents of the United States sit for busts executed by him, including one of the late President Wm. McKinley. There is scarcely a town or village in this country where one or more of these molds could not be used to advantage. There is no business that we know of that will insure more handsome returns than a set of these molds, manufactured and sold only by the Miracle Pressed Stone Co., Minneapolis, Minn.



No. 2. Tall Headstone.

86 inch high. 30x20 inch base.



No. 3. Headstone and Cross.
66 inch high. 30x30 inch base.



No. 4. Low Headstone.
22 inch high. 24x18 inch base.



No. 5. Low Headstone.
24 inch high. 18x24 inch base.

CONSUMPTION OF RAILWAY TIES, POSTS AND TELEGRAPH POLES.

The railways of the United States consume each year one hundred million ties, three-fourths of which are hewed. White oak furnishes nearly one-half of the hewed

ties, and constitutes, with the exception of lumber the greatest drain upon our oak forests, two-fifths as much oak being used for ties as for oak lumber, 18 per cent. of southern pine is consumed for ties, 8 per cent cedar and 7 per cent chestnut, cypress, tamarack, hemlock, western pine and red wood being used for ties in certain localities.

Telegraph, telephone and electric light companies in 1906 purchased 3,493,025 poles exceeding 20 feet in length, while a large number of shorter poles were consumed of which there is no definite data. Here is an immense field for the introduction of concrete railway ties and telegraph poles when the inventors so far perfect their concrete ties and telegraph poles as to make make them acceptable to the consumer. In as much as the Italian government has adopted concrete ties on several of its principal railways lines and is extending the use of concrete ties on other lines, the time must come when they will be adopted in the U. S. The Chicago and Alton Ry. has already adopted the concrete railway tie on its line and is advertising the fact very extensively. It would require at least 20 millions barrels of cement annually to produce the one hundred million railway ties required each year. The wooden fence post is being gradually displaced by the reinforced concrete post. Twenty million cedar posts, were cut in the Lake States alone in 1906. Wood posts cut elsewhere, including cedar and other woods, will amount to from 150 million to 200 million posts. Here is another inviting field for the use of concrete.

THE EFFECT OF CEMENT ON REFRACTORY LININGS.

Some particularly interesting experiments have recently been made by Dr. Loeser, of Halle, Germany, with a kaolin of great purity and material for lining cement kilns and enabling them to resist the corrosive action of the cement clinker.

The first experiments were made with a kaolin of great purity and of a composition corresponding to the best samples of china-clay, in which all the silica was combined with the alumina so as to give a material which, theoretically, was perfect in refractory power. The result of using this material was most disappointing, and even when the quantity of alumina in the mixture was increased to 45 per cent on the fired clay (the highest proportion of alumina which can theoretically combine with the silica) the results were no better. Consequently it would appear that a high alumina content is not, in itself, sufficient to produce a refractory material which can successfully resist the action of hot cement clinker.

When the refractory material was coated with a thin covering of an artificially prepared alumina ("Diamantin") completely satisfactory results were obtained, and a prolonged heating (extending over many hours) of the cement in contact with this diamantin proved to have no effect upon it whilst the protected portions of the kiln lining were completely eaten through.

It therefore appears probable that a comparatively small proportion of silica in the refractory lining of cement furnaces is a serious disadvantage to the life of the latter, and that cement manufacturers would find it more economical to use a thin lining of diamantin or other fairly pure alumina as a protection to the ordinary refractory clay blocks now used.

Dr. Loeser is continuing his experiments in order to ascertain what proportions of clay and alumina can be used in order to obtain a satisfactory material with great heat and corrosion resistances at a reasonable price, artificially prepared alumina being somewhat too costly for general use.

The particular form of alumina he used is not at all well known in England, but it appears to be highly probable that carborundum, which is being imported in large quantities from the United States, or even blocks or thin slabs made of bauxite, would be equally satisfactory, though at the present moment we have no detailed information on this matter.

REINFORCED CONCRETE CAISSONS.

An interesting piece of construction in reinforced concrete has recently been carried out by Messrs. Robert McAlpine and Sons, of 25, Victoria street, S. W., in the building of the caisson foundations for a bridge over the River Foyle, to carry the Strabane and Letterkenny Railway, for which they are the contractors, and Mr. James Barton, M. I. C. E., is the engineer. These caissons are constructed of sections, moulded and dropped into place complete.

The bridge is of the ordinary steel lattice girder type. The interesting part lies in the piers which have been sunk to foundation level by the caissons referred to. Instead of using brickwork constructed on the top of a heavy iron curb, or a metal caisson throughout, the reinforced-concrete caissons are built up of a number of super-imposed sections, as shown in plan and sectional elevation in Figs. 2 and 3 on a plan patented by Mr. T. Malcolm McAlpine. Fig. 1 shows some of these sections in the moulds on the shore and others removed from the mould. the chains of the crane being seen fixed to one ready for lifting into position. Fig. 4 shows the crane and other views of the sections of the caissons on the shore.

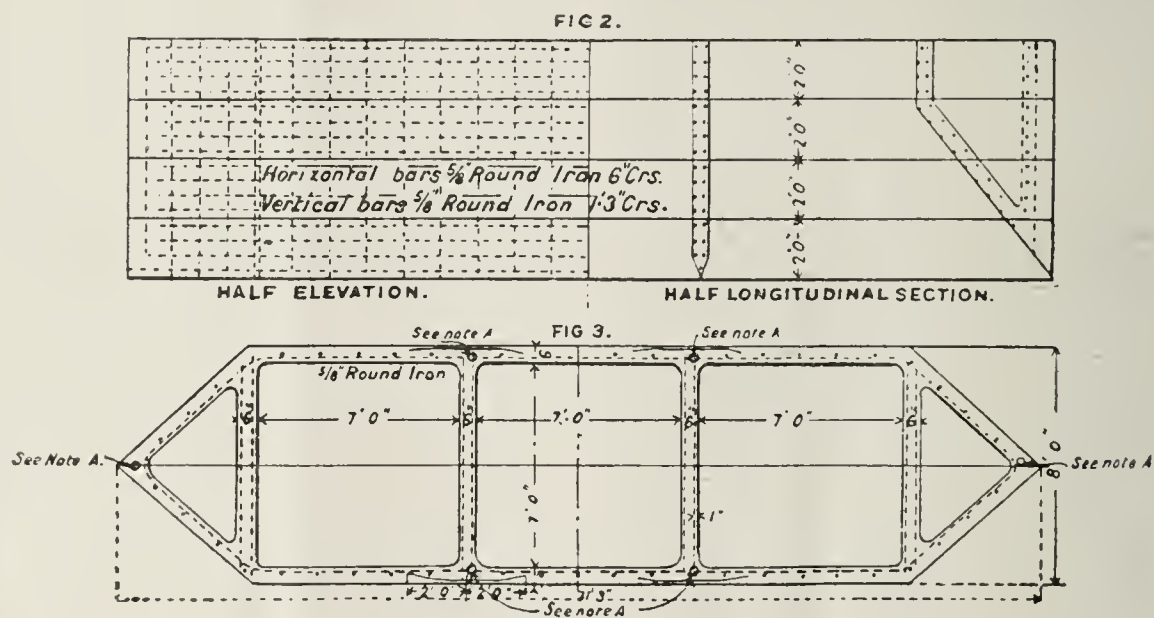
Each section was allowed to harden for four weeks before being lifted by the crane, and each successive section was guided into place on the one below by means of the vertical rods to be seen in Fig. 6. These rods extended to the last section up to above surface of the water, and a new section, when being placed into position, was simply slung over these bars, which ensured its resting truly in line with the next one below.

The weight of each section varied from 7 to 8 tons. The concrete used consisted of 4 parts of gravel to 1 of cement, and the reinforcement consisted of $\frac{5}{8}$ -in. round bars, the details of which are shown in Figs. 2 and 3.

One detail of the work may be found useful in similar circumstances. It was important to secure a good joint between the sections of the caissons, but when these were lowered into the water, naturally any cement would stand a chance of being washed away. The following plan was adopted and found thoroughly serviceable. A small groove was provided on the upper surface of each section, while the bottom of each was furnished with a small wedge-shaped projection. To make the joint, a sausage of cement



Fig. 1. Sections of Caissons in molds.



Note.—At points marked A 2-in. vertical bars continuous from bottom segment to above water level, where caisson can be made in situ, to be placed in the bottom segment and holes left in other segments.

mortar encased in linen was placed in the groove, and on the upper section being lowered into place its wedge-shaped projection dug into the soft cement mortar, and made a joint which proved quite watertight.

No staging, piling, or hydraulic jacks were used in constructing these foundations and the caissons proved to be only half the cost that would have been necessitated for steel caissons.—Builders Journal and Architectural Engineer.

The West Coast Portland Cement Co. is to finance the construction of

a cement plant on the upper Snake river in Idaho; a force of men from Lewiston, Idaho, has been selected to commence building operations. J. M. Edwards of Lewiston, Idaho, is Vice President of the Company.

The city of Dayton, Ohio, council has authorized the issue of \$170,000 for the construction of a concrete bridge over the Miami river. Litigation with the Oakwood Railway Co. to compel that company to bear one third of the cost of the bridge is pending in the Circuit Court and is to be decided May 28, after which the work will be let.

ARTESIAN WELLS.

The Chinese and Egyptians were familiar with artesian wells before they were known in Europe. These wells take their name from Artois an ancient province in the extreme northeast of France, which is now known as Pas-de-Calais, where a well was sunk in the old Carthusian convent at Sillens in this province in the year 1126. Another well was developed at Modena, Italy, about the same time. The most famous artesian well in Europe is located at Grevelle, near Paris, being 1798 feet in depth, yielding 516 gallons of water per minute.

One of the earliest artesian wells in the United States was that sunk at Fort Monroe, Va., in 1845. Its depth, however, was not very great—only 168 feet. Another early well was the one begun at St. Louis in the spring of 1849 and finished five years later, when it had reached a depth of 2,199 feet. Since 1860 thousands of deep wells have been bored in the United States, the most important artesian districts bring those of South Dakota, Texas, and southern California.



Fig. 4. Lifting a Section of Reinforced Concrete Caisson with a Crane.

PORTLAND CEMENT IN CHEMICAL WORKS.

It is not generally known that Portland cement resists the action of concentrated sulphuric acid to a remarkable extent. As a jointing material for filter plates, through which the acid is filtered, it has proved itself almost beyond equal. This naturally suggests other possible fields of usefulness on a chemical works. Concrete storage tanks for petroleum have been tried, but have shown themselves too porous, and there are great possibilities for a material for rendering cement proof against petroleum, tar oils, etc. Among minor uses on such works may be mentioned the repair of broken plugs for acid cocks. One such job has proved entirely satisfactory. The broken surfaces should be thoroughly wetted, covered with a paste of neat cement, and have a collar of the material moulded round the joint. Tanks for storing alkaline and neutral solutions of many kinds are cheaply constructed in concrete, and show many advantages over other constructions. Concrete bins and silos have long been in use, and their erection nowadays scarcely awakens the least interest.—British Clayworker.

THE RESIDENCE OF W. J. WILSON AT WARKWORTH, NEW ZEALAND.

This is the first reinforced concrete dwelling house constructed in New Zealand. It was built by Witsion & Co., cement manufacturers, works at Warkworth, about 70 miles north of Auckland and is occupied by W. J. Wilson the General Manager of this plant. The house has all the latest modern improvements, such as electric light telephone, hot and cold water and sanitary conveniences, the electric light being supplied from the power house of the cement works.



Concrete House of W. J. Wilson, Warkworth, N. Z.

CEMENT FOR THE PANAMA CANAL ZONE.

Bids will be opened on May 1st for the transportation of materials to be used in the construction of the Panama Canal, one item of which will cover 4,500,000 barrels of Portland cement. There is some doubt in the minds of people interested in ocean transportation of the ability to supply the vessels to convey these supplies in time as only American bottoms can be employed in this traffic, which may compel the government to purchase supplies abroad.

REINFORCED CONCRETE STANDPIPE.

What is doubtless the largest reinforced concrete standpipe yet constructed is that built for the town of Attleborough, Mass., by the Aberthaw Construction Co., of Boston. Its erection was necessitated by the inadequate fire protection and the lack of water for domestic purposes provided by the then-existing pumping station. Although Attleborough water is of the best, it contains so much carbon dioxide that the serviceability of iron tanks is of comparatively short duration. On this account bidders were allowed to present plans and specifications according to their own ideas of construction, each one specifying the amount of steel to be used, amount of concrete, and factor of safety, with complete plans and method of construction, confining himself to the general design of foundation, standpipe, and gatehouse; the structure was to be guaranteed by the builders for one year from date of acceptance by the commissioners.

"After a careful study of all plans submitted and methods of construction proposed, we considered," so says Superintendent George H. Snell in his report, "that the Aberthaw Construction Company's bid (\$21,000) was the one to accept, any, for the following reasons: Extra steel reinforcement, richness of concrete, method of construction, and complete plans submitted.

"We had an estimate on a steel standpipe of the same size for \$37,135, making a difference of cost between that bid accepted, \$3,135.

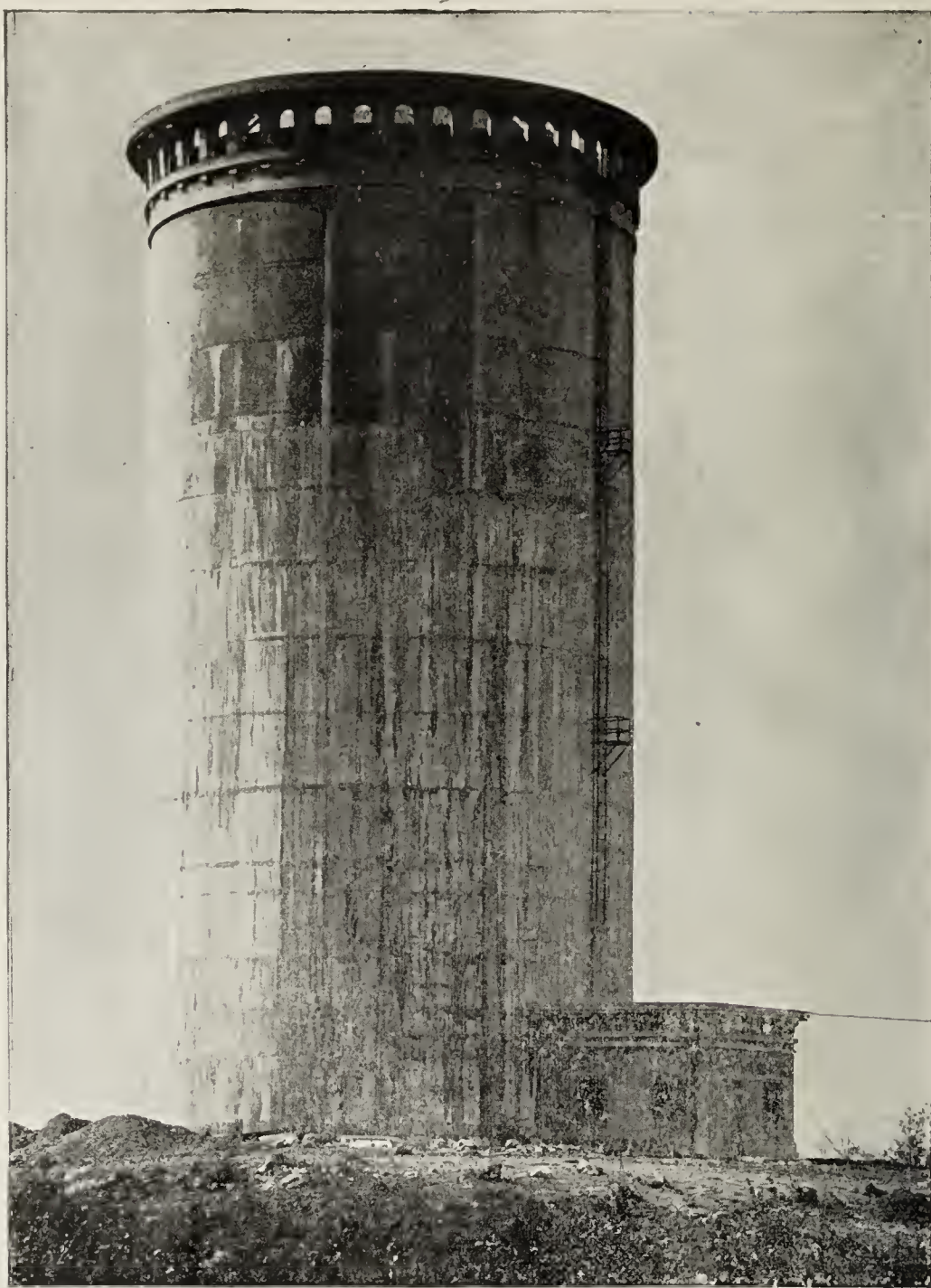
"The advantages of a concrete steel standpipe over a steel standpipe are:

"First.—The cost would be \$3,135 less.

"Second.—No cost of maintenance.

"Third.—There seems to be no limit to the life of such a structure; or, in other words, is as nearly indestructible as a structure could be made.

"The maintenance of a steel standpipe of that size with our quality of water would be \$400 per annum if kept coated on the inside and painted on the outside, and the probable life only twenty years. It would also be necessary to empty the tank annually to clean out the rust and do the painting, which would probably take at least two weeks. During that time water would have to be supplied by direct pumping, which means continuous expense of not less than one hundred dollars per annum. You can see, by this comparison, that there was much in favor of the concrete



The largest reinforced concrete standpipe, Attleborough, Mass.

steel standpipe over the steel standpipe. It seemed to us, in our judgment, it was far better to accept the concrete proposition."

The standpipe in question is 118 ft. high by 50 ft. inside diameter, with an adjoining gate house 18 ft. x 18 ft. x 16 ft. high. The walls are 18 inches thick at the ground level and 8 inches thick at the top. At a depth of 7 ft. was found a good hard bottom on which to rest the concrete foundation. A reinforced fillet of generous proportions connects the walls and bottom pan. Extending entirely around the base of the tower is a reinforced concrete curbing 14 ft. thick by 3 ft. high rounded at the top.

The concrete used was of the proportion, 1 part cement, 2 parts sand and 4 parts crushed stone.

Horizontal reinforcement consists of round bars varying in diameter from $\frac{1}{4}$ inches to $1\frac{1}{2}$ inches. It was originally intended to use $\frac{3}{4}$ inch twisted bars for vertical reinforce-

ment, but as the difficulty of keeping the horizontal members in place was met with, channels were substituted, there being 15 in number equally spaced. These were drilled at intervals for the reception of short $\frac{1}{2}$ inch bars upon which to rest the horizontal bars. This method of holding the latter members in place was all that could be desired. The horizontal bars were delivered in lengths of $56\frac{1}{2}$ ft., necessitating the use of three to span the circumference with an overlap of each of 30 inches with which to clamp them together. The bottom pan and fillet is reinforced by $\frac{1}{4}$ inch bars spaced 6 inches, running at right angles to each other.

In the final design the horizontal steel reinforcement consisted of $1\frac{1}{2}$ inch plain round bars in double vertical rows extending from the ground to a height of 60 ft. Above this a single row was used which at 81 ft. was reduced to $1\frac{1}{8}$ inches diameter. The steel is protected

throughout by from $2\frac{1}{2}$ to 3 inches of concrete. The spacing of the double horizontal steel members varies from $3\frac{3}{4}$ inches centre to centre to 8 inches; that of the single $2\frac{1}{2}$ inch row $4\frac{1}{2}$ inches to 6 inches, and that of the $1\frac{1}{8}$ inches row $3\frac{1}{2}$ to $6\frac{5}{8}$ inches on centres.

In order to make the standpipe thoroughly tight, alternate coats of a solution of castile and alum were applied to the interior, the first 33

BURIAL VAULT MOULDS.

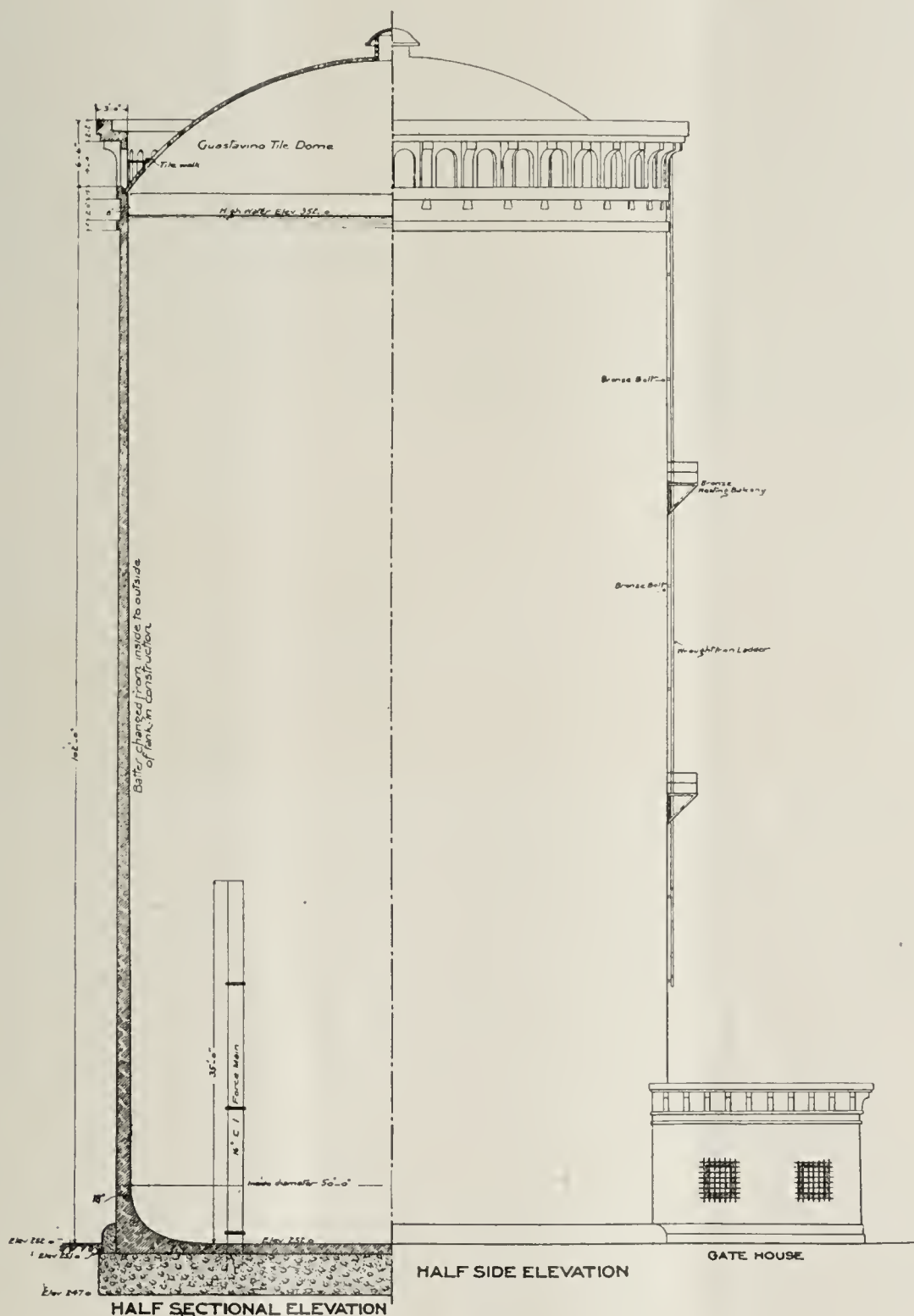
Concrete for the living, concrete for the dead, is absolutely true. We live in cement houses, walk on cement sidewalks, ride on cement streets and now people are being buried in cement vaults. The Hoosier cement burial vaults and arched covers are formed in steel molds; these vaults are strongly reinforced, they have but one point between the lid and the box; when in place they

Our machines make the following sizes of vaults: all one one and the same machine, which is easily adjusted for various sizes: $4\frac{1}{2}$ feet long, 5 feet long, $5\frac{1}{2}$ feet long, 6 feet long, $6\frac{1}{2}$ feet long, 7 feet long, 7 feet 3 inches long; any depth you desire from 12 inches up to 26 inches. Any width as follows: 22 inches, 24 inches, 36 inches, 28 inches, 30 inches and 32 inches. The above dimensions are all net inside measurements. The walls, top and bottom are $2\frac{1}{2}$ inches thick making the outsides of vaults 5 inches larger than measurements above given.

One yard of sand will make three average size vaults with a mix of one part cement with two or three parts of sand, one man can make two average sized vaults per day. The same mould can be adjusted to make water and milk troughs.

We are informed that there is a margin of five hundred per cent from the product of the Hoosier cement vault and trough moulds. A cut of the vault appears in an advertisement on another page of this issue. Full particulars will be given on application to the manufacturers.

Ball & Brookshire,
Thorntown, Indiana.



Concrete-Steel Stand Pipe at Attleborough, Mass.

ft. with eight and the remainder with four coats.

Circulation of water is insured by discharging into the standpipe through a pipe at the bottom of the tank.

The top of the tower is covered by a Gustavino tile roof and ornamented by concrete pendants.

furnish sealed vaults proof against vermin and they increase in strength with age.

The manufacture of cement burial vaults present an inviting field as a new line for the cement worker who desires to enlarge his income. The Hoosier cement vault machine is adjustable and will produce the following sizes:

CONCRETE ARMOR FOR WAR SHIPS.

The French government has been experimenting with concrete as a blocking for armor plate on war ships. The concrete is placed between the inner and outer steel plates which constitutes the vessel's hull. The exact mixture is a secret. This compound hull develops a very high resistance to projectiles fired from the heaviest guns. Italian naval officers are advocating concrete reinforcement for new ships for the Italian navy. Cement blocking was used in the Russian navy for several ships during the Russian-Japanese war. Reinforced concrete has long been employed in coast defense fortification in Europe and America, where it has given the best satisfaction in experimental gun fire.

The Piedmont Cement Co., of Atlanta, Ga., capital \$600,000, has purchased for \$20,000 a tract of land from J. S. Davitte, at Davitte, Ga., at the junction of the Sea Board Air Line, and the Louisville & Nashville Railway, upon which they propose to erect a cement plant. Dr. Edgar Everhart is president of the company; M. E. Morris, treasurer; and E. C. Lester, secretary, all of Atlanta, Ga.

England imported 7,820 tons of cement in December, 1907, of which 7,322 tons came from Belgium, against 10,841 tons imported in December, 1906, of which 10,109 tons came from Belgium, which is low grade and consequently sold below the regular market price, for good cement.

FIRE AND EARTHQUAKE PROOF BUILDINGS.

The city of Kingston, Jamaica, which suffered from an earthquake in January, 1907, has adopted stringent building laws against shoddy construction, by requiring that all buildings in the future must be as near earthquake proof and fire resisting as possible, by conforming to the following specifications. The walls of buildings may be constructed of brick, concrete, stone, or other hard and incombustible material; and they must be built on a foundation of cement concrete. Walls built of brick, dressed stone or other similar materials must be solidly put together with Portland cement mortar, and be reinforced by hoop or band iron not less than one inch wide and one-twentieth of an inch thick. Walls of cement concrete shall be composed of Portland cement, clean sand, and clean broken brick, or stone, and shall be reinforced by steel or iron bands, bars or wires. Roofs must be covered externally with hard, durable and incombustible material. Iron and steel framing specially manufactured for the construction of buildings and Portland cement are exempted from duty until April 1st, 1909.

COST OF MAKING CONCRETE PIPE.

The following estimates of cost of concrete pipe manufactured by force account on the Shoshone Irrigation Project are based on the results of five days work in November, 1907. The cost of cement was \$3.05 per barrel, of sand about \$1.40 per cubic yard, and of labor \$5.00 per day for one foreman, \$3.00 per day each for two men and \$2.75 per day each for two men. Plant depreciation and administrative expenses are not included in the unit costs given. The concrete was made of one part cement and three parts sand. The size and the thickness of the pipe, the weight and the unit cost per linear foot thereof and the number of linear feet manufactured in the five days are tabulated below:

Diameter, Inches.	Thickness, Inches.	Weight per linear foot, Pounds.	No. feet made.	Unit Costs
12	1½	56	144	\$0.25
18	1¾	94	248	.37
24	2	143	56	.57
36	3	366	54	1.15

CONCRETE MATERIALS IN THE CHICAGO DISTRICT.

Practically all the concrete material and nearly all the ordinary dimension stone and common clays consumed in Chicago and its environs are produced within the Chicago district, according to Mr. Ernest F. Burchard, of the United States Geological Survey, who defines the district as an area of about 3,900 square miles, bounded on the east by the Illinois-Indiana State line, on the south by an east-west line passing about 7 miles south of Joliet, on the west by the west line of Kane and Kendall counties, and on the north by an east-west line passing just north of Lake Geneva, Wisconsin.

The concrete materials produced in this district consist, in order of quantities, of crushed magnesian limestone; sand; gravel, part of which is crushed; and Portland and natural cements. The cements, however, though manufactured in Chicago, are strictly not composed of local materials, as the limestones that enter into their compositions are brought from Fairmount, a point in east-central Illinois about 100 miles south of the district. The granites, marbles, and finer grades of dimension stones, flagging, curbing, and fire clays are brought from various outside States.

The value of the various materials used in concrete work in the Chicago district is difficult to obtain, as producers are not always able to state definitely the uses to which the whole of their output of broken stone is put. On the assumption, however, that all crushed stone produced except that sold for flux and lime burning was concrete material, the value of this product in 1906 was nearly \$2,000,000. The value of the sand produced during the same period was \$205,000 and that of the gravel \$198,034. The total value was therefore a little less than \$2,500,000. Figures for 1907 are not yet available, but it is improbable that they will greatly exceed those of 1906, as building operations during 1907 were considerably curtailed.

In connection with extensive studies of the structural materials of the United States at the laboratories of the Survey in St. Louis, Mr. Burchard spent several weeks in the summer of 1906 in Chicago and vicinity, obtaining representative samples of concrete materials. A brief report on this work has just been published by the Survey in an advance chapter from Bulletin 340, which forms Part I of "Contributions to Economic Geology, 1907." Copies of this report may be obtained without charge by applying

to the Director of the Survey at Washington, D. C. Mr. Burchard noted the location, extent, and geological relations of the deposits sampled, so as to supplement the data to be obtained experimentally, and when the laboratory work shall have been completed a detailed report on the subject will be published.

In view of the rapid advances being made in concrete construction, the importance to Chicago of a nearby and adequate supply of raw materials for concrete work is very great. Mr. Burchard's paper points out the available sources of limestones, sands, and gravels, and briefly outlines the methods of preparing them for use.

A PLEA FOR CONCRETE BRIDGES.

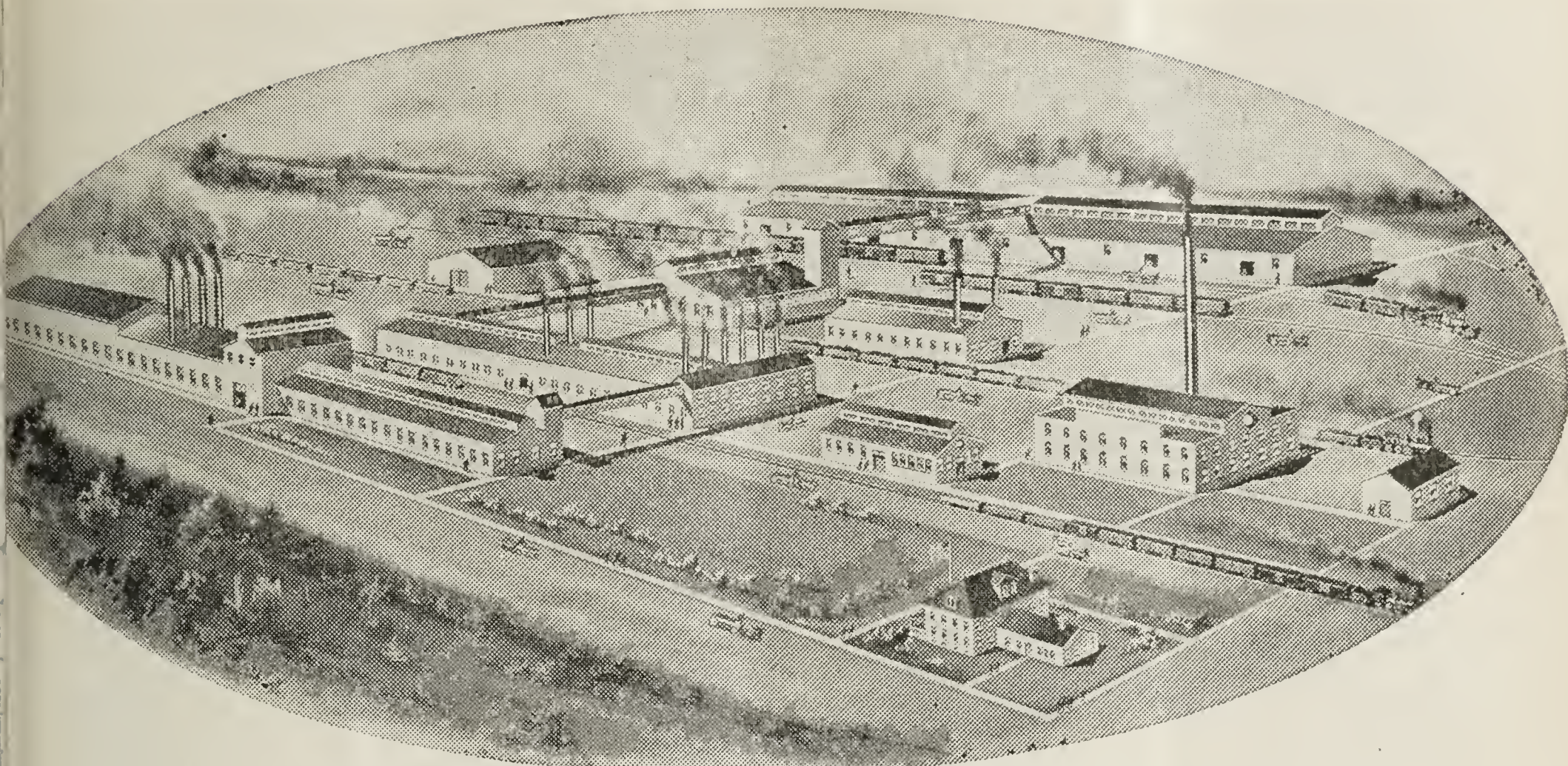
The Parkville Gazette, of Platte county, Missouri, makes the following plea for concrete bridges:

"The railroads are spending thousands and thousands of dollars in the construction of concrete culverts and bridges in Platte county, because they are permanent. Why don't the county make a move in that direction? Build some every year. Make a start, this year, if only one is built. Build the arch, fill in over it, and you are done with that place. No paint, no repairs, if the work is done properly in the first place, and a better road over every stream where such a crossing is built. We believe this subject is worth the consideration of the Platte county court.

Pick out a place where a bridge or culvert is needed and make a start in 1908. Future generations will rise up and bless the court who made the start giving Platte county such a system of concrete bridges.

The faculty of State college at Manhattan has recently made public the result of investigations on concrete paving for streets and alleys. Data is given from Richmond, Ind., where since 1896, concrete pavement has been subjected to the severest test, and is to-day, after eleven years of hard usage in good condition and shows but little need of repair. It was put down at a cost varying from 14½ cents to 16½ cents a square foot. A medium price would be \$1.40 a square yard.

The California Portland Cement Co. at Colton, Cal., report that the sale of cement during March was greater than at any previous time during the existence of the plant.



Plant of Continental Portland Cement Co., Nearing Completion at St. Louis, Mo.

THE CONTINENTAL PORTLAND CEMENT CO.

The Continental Portland Cement Co., of St. Louis, Mo., has a plant under construction just outside of St. Louis at the junction of the Missouri Pacific and the Frisco lines. The new material consists of limestone and clay. The lime rock deposits cover 100 acres and over 100 feet in depth. The fuel supply is to be drawn from the Illinois coal fields close at hand. A dam across Gravors' Creek just north of the plant will yield an unfailing supply of water. The plant will consist of eight buildings, kiln 96 x 234 feet, raw material house 95 x 410 feet, finishing house 96 x 100 feet, coal house 30 x 80 feet, machine shops 30 x 60, ware house 360 x 75 feet, power house 87 x 135 feet and office building 18 x 40 feet. Simplex concrete pile foundations, of which 1,500 piles will be used, placed by the Crawford Paving Co. The machinery installation consists of a No. 9 McCully crusher which weighs over 82 tons and is manufactured by the Power & Mining Machinery Co., of Milwaukee. This crusher has a capacity of from 200 to 400 tons per hour. Two No. 5 McCully crushers will likewise form part of the installation. Two dryers each 6 x 60 feet which take the material from the two No. 5 crushers.

The plant will be completed about July 1 and will have a daily producing capacity of 3,000 barrels. Among those in the party were the officers,

President John Davis Marks, St. Louis; vice president, John A. Cruishank, Bellefontaine, O.; secretary, Dwight Harrison, St. Louis; treasurer, Louis Fusz, St. Louis; and directors, Charles F. Ritter, Covington, Ky.; Otto C. Oehler, St. Louis; John S. Littleford, Cincinnati, O.; O. B. Brown, Dayton, O.; H. L. Parker, St. Louis; S. M. Brandbury, Cincinnati; R. V. Burkhardt, Dayton, O.; George Beck, St. Louis; T. J. Cookson, Cincinnati; C. H. Morrill, St. Louis; J. L. Ballinger, Plain City, O.; D. H. Kirwan, Plain City, Ohio.

NEW GERMAN FREEZING APPARATUS.

It is reported that the model of a newly invented freezing and refrigerating apparatus has recently been privately exhibited in Hanover, and promises to effect a considerable economic result in the future physical comfort and health of man. The device is an extremely simple and inexpensive affair, costing perhaps not more than 4s. to 5s. to manufacture. It consists of a double-wall tin vessel with a capacity of 5 gallons or more. There is a hollow space between the two walls, or inner and outer vessels. This space completely surrounds the inner compartment and is about an inch in width. By the graduated admission of carbonic acid to this surrounding chamber at the bottom of the vessel, and from this

surrounding chamber into the vessel proper at the top through a cross-arm tube, the contents of the vessel are frozen quickly and completely. Meats, fruits, bottled beverages, such as beer, champagnes, wines, etc., may be chilled or frozen in a few seconds. This effect is produced by the sudden great reduction of temperature caused by the rapid expansion of the carbonic acid, which is admitted from an ordinary carbonic reservoir. The invention is at present designed for the hotels, restaurants, hospitals (particularly field hospitals), and the ordinary household.

The City Council of Los Angeles, Cal., has authorized the Board of Public Works to contract with the Southern Pacific Railway Co., for the construction of two switches from the main line to the site of the proposed cement plant to be erected to furnish cement for the Los Angeles aqueduct.

H. A. Ernst, M. E., of Chicago, is delivering a course of lectures on concrete construction before the Association Institute of the Young Men's Christian Association, of Chicago, at 153 La Salle st. Mr. Ernst is well qualified to handle the subject from a theoretical as well as a practical standpoint based upon years of actual experience in reinforced concrete construction.

The Puritan Cement Co., of Hamden, Vinton county, Ohio, is to manufacture a cement which is to be used in the plant for producing vitrified cement blocks directly from a 50 ton steel furnace now in process of erection.

The Marquette Cement Co. at La Salle shipped 12,862 barrels of cement over the railroads on Monday, April 6.

The working force of the Nazareth Portland Cement Co. has been changed. A. F. Krable, superintendent; O. A. Bunn, chief engineer; W. H. Kleckner, general foreman. John Fairchilds and Wm. Stout, mill foremen, have been retired. Willis Lauder, of South Easton, formerly superintendent of the Buckhorn Cement Co. at Manheim, W. Va., is the new superintendent. Mr. Judd, of Easton, is the chief engineer and Mr. Kleppinger, of Bath, the new general foreman.

INCORPORATED.

The Cement Securities Cement Co., of Denver, Colo., has been incorporated with a capital stock of \$6,000,000. It will be the holding company for the principal cement companies in Colorado, Utah, Montana and Texas. The company was formed for the protection of the cement companies in the above named states. The directors are Charles Boettcher Whitney Newton, M. S. Browning, M. D. Thatcher, Joseph Scawcroft, F. T. McBride and James Pingree. The incorporators are M. D. Thatcher, Robert Gast and Chas. E. Gast. The incorporation fees paid by the company to the state amount to \$1,335. Since the incorporation papers were prepared Charles E. Gast has died.

PITTSBURG PLASTER CO. FAILURE.

In an equity suit commenced April 13 in the United States Circuit Court, Judge Joseph Buffington appointed Charles H. Reed, receiver of the Pittsburg Plaster Co., which has offices and an uncompleted plant at Lodi Valley and Allegheny Valley Railroad. The action was brought by the Interstate Gypsum Co., of Buffalo, and Addison F. Allen, a stockholder of Warren, O. The defendant company has a capital stock of \$75,000. The value of its real estate is given as \$65,000 and there are a number of unpaid subscriptions to the stock. It has large contracts for plaster, but has not yet completed the plant for manufacturing.

Judge Buffington directs the receiver to wind up the business and enjoins creditors from other legal action. The plant is covered by two mortgages amounting to \$51,500 and there are other claims in excess of \$10,000. An answer filed by the company admits the allegations of the petition. It is signed by A. J. Hoffman, president, and George E. Flaccus, solicitor.

The N. S. P. Manufacturing Co., of Newbury, Orange county, N. Y., has been incorporated with a capital stock of \$200,000 for manufacturing cement, plaster, etc. W. J. McKay, R. L. McKay, B. McClung, Newburg, N. Y., and others.

The city of Springfield, Ill., has one hundred streets to be improved with cement sidewalks curbs and gutters during the present season.

The Chicago Portland Cement Co. has given a deed of trust to the Chicago Title & Trust Co. to secure a bond issue of \$500,000, on its plant at Oglesby, Ill., and certain improved real estate in Chicago payable in 6 years from date, the bonds bear interest at 6 per cent. The funds realized from the sale of bonds will be used to retire outstanding paper.

The principal indebtedness of the company is said to have been incurred in recent remodeling and enlargement of its plant.

Ten cents per barrel on each barrel sold, will be used as a sinking fund to meet maturing obligations.

The bonds mature as follows: \$75,000, Feb. 1, 1910; \$75,000, Feb. 1, 1911; \$100,000, Feb. 1, 1912; \$100,000, Feb. 1, 1913; \$150,000 Feb. 1, 1914.

A delegation of angry butchers and marketmen of San Francisco, Cal., appeared in a delegation before the building laws committee of the supervisors on April 15 to protest against the ordinance requiring the floors of markets to be of concrete. They said the health board had instructed them to substitute concrete for wooden floor in their business places, causing them unnecessary expense. The protestants were informed that the ordinance applied to markets constructed in the future and not to those already built. Clerk Behan was directed to instruct the health board not to make the law retroactive.

The Portland Cement Company of Portland, Chautauqua, N. Y., has been incorporated with the Secre-

tary of State with a capital of \$15,000. The directors are J. G. Corell, Louise A. Correll, F. C. Bertram, of Portland, and J. L. Campbell, of Brocton, N. Y.

The Utah and Nevada Plaster and Cement Co., of Salt Lake City, has been incorporated: John Sharp, Pres.; C. S. Tingly, Vice-Pres.; Jas. Christensen, Treas., all of Salt Lake City.

The McAlester Portland Cement Co., of McAlester, Okla., is to expend \$75,000 for buildings and \$300,000 for machinery in the construction of its plant. This is a somewhat indefinite estimate as neither architect or engineer have been employed to prepare plans. The officers of the company are: Prof. E. T. Gould, state geologist, Norman, Okla., president; A. C. Farmer, vice president; H. E. Swan, secretary and manager, both of McAlester, and J. F. Riley, of Oklahoma City, is treasurer. The company will expend \$75,000 for buildings and \$300,000 for machinery. It has not yet engaged the engineer and architect.

The Alma Cement Company started up its plant on April 3. A reduced wage scale commenced with the opening of the plant.

The Dakota Portland Cement Company has been incorporated at Chamberlain, S. D., by D. B. Zimmer, James Brown and W. H. Pratt, Jr., of Chamberlain, and Eugene Sanger, C. O. Bailey, J. H. Voorhees, and F. B. Eaton, of Sioux Falls. The company will have a capital of \$2,000,000, and will develop deposits of raw material along the Missouri River near Chamberlain.

The Aetna Portland Cement Co. at Fenton, Mich., is to be sold on May 9th in pursuance of a decree of the Circuit Court rendered by Judge Wisner. The sale will take place in the Genesee county court house at Fenton, Michigan, on the date above named. It is expected that the heavy bond holders of the company will bid in the plant and open the work by June first under a new organization.

The Hecla Cement Co. which has been overhauling its plant during the winter expected to start up full capacity early in April. Supt. E. A. Leh said he expected to run continuously through the season.

BOOK NOTICES.

The E. I. DuPont DeNemours Powder Co. is sending out a small volume handsomely bound in tan morocco, 216 pages, illustrated, title of which is "Useful Information for Practical Men." Price \$1.00, limited edition. We find this to be a most valuable book containing information on rock drilling, crushing machinery, boilers, light locomotives; contains general tables, such as weights, mensuration, temperature scales; also goes into the subject of roofing, velocity of pulleys, recipes for cleaning and repairing parts of machinery, first aids to the injured in manufacturing plants, and very minute details about all kinds of explosives. It is well edited throughout, with a very comprehensive index.

The Link Belt Co., Philadelphia, Pa., has just issued a new chain catalog No. 75, for 1908, giving a complete list with illustrations of every style of chain, link, wheel, scraper, etc., which they manufacture or handle. They have also issued a small special pamphlet entitled, "The Original Ewart Link Belt, How to Use and Why." The above will be mailed without charge.

"Handbook of Concrete Steel Constructions," a progressive history and theory of concrete constructions, edited by Dr. Ingenieur F. Von Emperger, published by Wm. Ernst & Sohn, Berlin, Germany. The first volume has just been issued; contains 449 pages, numerous illustrations and tables. Price, paper bound, 18 marks; cloth bound, 21.50 marks. Vols. 2 and 3 have already appeared. This valuable book is a large volume divided into two chapters. The first chapter, entitled the "Principal Features of the Progressive Development of Steel Concrete Construction." The subject is most exhaustively treated, being divided into headings (1) a historical account of the use of concrete and cement since the early days in the 18th century, which was a forerunner of the modern steel and concrete construction work. (2) the first beginnings in concrete steel constructions. (3) the principal features of the progressive development of steel concrete construction in Germany and Austria; also in France, the Netherlands, and in Switzerland, and in the Northlands, especially in Denmark, and Russia. (4) the modern application of steel concrete construction, and the most important steps in the present manner of building.

Chapter II, entitled, "Theories and Experiments," is divided into five principal headings, a, b, c, d, e, which are again subdivided into many different parts.

(a) The resistance of simple, armored, and interlaced concretes. Under this heading is "Columns." Experiments with columns, giving computations, and accounts of experiments made by experts in different important cities of the world, both in Europe and the United States. Also experiments with reinforced concretes in the same manner.

(b) Experiments with beams of steel and concrete, showing tests made by many experts throughout the world, on the resistance of beams, slabs, etc.

(c) Theory of Steel Concrete Beams. Under this heading we find the development of the elasticity theory in questions relating to the properties of concrete and steel. Comparing the foundation of the elasticity theory of homogeneous beams with those of steel concrete beams. Simple Elasticity (without axis pressure). Elasticity (with axis pressure).

(d) Experiments with arches. Under this are Berlin tests, experiments in Vienna with Monier constructions. Experiments in Matzleindorf with Monier arches. Description of experimental stations, etc. Tables on arches.

(e) Theories of Arches and especially of steel concrete arches. The outer and inner stress of arches. Analytical research. Action of temperature changes. Action of loads. Approximate reckoning on single span arches. Approximate reckoning for determining the most favorable form of arch. Reckoning for obtaining the strength of steel concrete beams and their reinforcements.

Bulletin No. 18. "The Strength of Chain Links." by O. A. Goodenough and L. E. Moore, has just been issued by the Engineering Experiment Station of the University of Illinois.

A series of experiments on chain links and circular rings, covering a period of two years, has been made for the purpose of confirming or disproving a theoretical analysis of the stresses in links and rings. A comparison of calculated and measured distortions affords the desired test. The result of the experiments is a complete confirmation of the analysis. Having a reliable theory, the bending moments and maximum stresses are calculated for links of various forms and the results of such

calculations are applied to the formulas for the loading of chains given by Unwin, Bach and Neisbach. It shows that the usual formulas for chain loads give maximum tensile stresses of 33,000 to 40,000 pounds per square inch, and maximum compressive stresses of 60,000 pounds per square inch. New formulas for safe loads are proposed. The bulletin is concluded with four appendices giving in full the theoretical discussion which is the basis of the experimental work.

This bulletin will be of special interest to all engineers and manufacturers who are concerned in any way with hoisting and transmission. Copies may be obtained upon application to the Director, Engineering Experiment Station, Urbana, Ill.

Bulletin No. 4. Year book for 1906, by H. Foster Bain, Urbana, Ill., postage nine cents, has been issued by the Illinois State Geological Survey; includes papers on typographic survey, Illinois fire clays, limestones for fertilizers. Silica deposits. 260 pages.

The Industrial Publishing Co., 16 Thomas street, New York City, has issued a small but very practical book entitled "How to Read Plans," by Chas. G. Peker, fully illustrated, 46 pages, sections, dimensions, scales, projection lines altering blue prints, mounting, etc.

Wilhelm, Ernst & Sohn, publishers, Berlin, Germany, have just issued their annual Beton-Kalender for 1908; a small hand book of steel concrete constructions, and miscellaneous information. It is published in two volumes. Part I, linen bound, 4 marks. Part II, paper bound, 4 marks. Part I. of this work contains 328 pages, with numerous illustrations and tables. Much valuable information is to be found in this little volume, such as statistics of the earth, population, measurements, etc. Telegraph service in European and other countries, giving prices of messages, etc. Postal service of European countries and others, prices, different kinds of service, etc. Weights and measures in use in different countries. The metric system. Mathematical Tables, Geometry. Information on loads, Elasticity; Building materials; Patents laws of Germany, etc. Part II, contains very complete information regarding building methods, such as foundations, walls, sidewalks, roofs, columns, floor steps, steel concrete bridges, canals, plants, silos, reservoirs chimneys, etc. Contains 368 pages.

CONCRETE.

By Edward Godfrey, structural engineer, for Robert W. Hunt & Co., 448 pages, 4 by 6, in morocco bound. Price, \$2.50 net. This book was written to promote sound principles in concrete constructions. The treatise is divided into four general divisions, as follows:

Part one.—Materials used in plain and reinforced concrete constructions.

Part two.—Is a reprint of articles on beams and slabs, columns, footings and retaining walls, published in current engineering journals.

Part three.—Reinforced concrete in the making and design of reinforced concrete arches, shear of concrete and its bearing on the design of beams.

The design of reinforced concrete columns, design of reinforced concrete chimneys.

30 pages of illustrations from working drawings of various kinds of plain and reinforced concrete structures.

Mr. Godfrey is an original and often at variance with some of the accepted formulas used in designing reinforced concrete structures. There is a strong view of common sense running through this treatise which will be appreciated by all interested in the live questions of the day relating to reinforced concrete design and construction.

The Hawkeye Portland Cement Co. is doing some extensive advertising throughout Iowa, to facilitate the sale of its stock. Its plant is to be built in Manou Co., Iowa.

The Michigan Alkali Co. is making extensive improvements in its quarries and docks. An elevated railway will be built to bay shore and immense docks and bins for crushed stone erected. The Huron Cement Co. plant, erected the past year at a cost of about \$1,250,000, will begin operations about May 1. The capacity will be about 2,500 barrels a day. Both plants are owned by the Michigan alkali stockholders.

The Standard Portland Cement Co. at Leeds, Ala. is to be enlarged in the near future, in order to meet the demand for the company's product. Mr. F. H. Levis, engineer and general manager of the plant, will be in full charge of the work.

The Ash Grove Lime and Cement Co., under construction at Chanute, Kansas, is well under way. Practi-

cally all of the machinery is on the ground, except the heavy grinding machinery. The works are to start in July. The Hunt Engineering Co. is to make a trial run with a full complement of men necessary to operate the plant before the owners take charge.

The McGrath Concrete Construction Co., of Green Bay, Wis., has been organized, to engage in the manufacture of concrete building blocks, sidewalk construction. The company has taken over the business of the Concrete Construction Co. of the same place. T. J. McGrath and W. H. Feild are the principal stockholders.

The Victorville Portland Cement Co. has been incorporated. Capital \$3,500,000. The company owns limestone deposits 8 1-2 miles northeast of Victorville, San Bernardino county, Cal. Works are to be erected near Victorville. Head office of the company will be at Los Angeles. The directors of the corporation are: F. H. D. Banks, So. Pasadena; Aman Moore, Los Angeles; F. H. Merrill, Portage, Wis.; James D. Schuyler, Los Angeles; J. W. Fuller, Catasqua, Penn.; F. T. Griffith, Los Angeles; A. A. Baird, Bairdstown, Cal.; O. A. Mulvane, Topeka, Kan.; Harrison Albright, Los Angeles; L. Blankenhorn, Pasadena; Homer Laughlin, Jr., Los Angeles; R. T. Tyron, Los Angeles; C. C. Kohlmeier, Los Angeles; Edward Groenendyke, Pasadena. Charles H. Hamilton, Pasadena.

Sandusky capitalists are reported to have purchased several hundred acres more of land at Castalia, Ohio, upon which a cement plant is to be erected. The machinery of a defunct Michigan cement plant is to be used in the new plant; \$100,000 is given as the capital of the new company.

The McGrath Concrete Construction Co., of Green Bay, Wis., is a reorganization of the Concrete Construction Co. of the same place, Chris. Van de Sande having sold his interest in the old company to W. H. Field. T. J. McGrath and Field will conduct the business of the new company as leading stockholders.

W. H. George, manager of the Henry Crowell Lime & Cement Co., of San Francisco, says building activity in San Francisco and other Bay cities is in a flourishing condition, as shown by our business relations with architects, contractors

and builders. Nearly all of the large buildings now under way are of reinforced concrete construction. The materials entering these structures are manufactured in California. This reduces the cost of construction, and has induced people to engage more extensively in building operations throughout the state.

Gasoline traction locomotives are now in extensive use in Europe for all kinds of industrial traction purposes, such as coal mines, stone quarries, contractors' plants, brick and cement plants. The Gasmotoren Fabrik Deutz of Cöln Deutz, Germany, produces complete installations from 8 to 24 horsepower.

The McAlester Portland Cement Co., McAlester, Okla., will establish a plant of from 1,250 to 2,000 barrels capacity, buildings and machinery to cost \$375,000, plant to be at Harts-horne, Okla.

The Crescent Portland Cement Co., Farmer's Bank Bldg., Wampum, Pa., desire bids on equipment for cement plant of 2,500 to 3,000 barrels per day. Curtin-Ruggles Co., 39 Courtland St., New York, engineers.

A new incorporation, known as the "Littlefield Concrete and Gravel Company," with a capital of \$10,000, has just started in business at Terre Haute, Ind. The directors are William Littlefield, Charles E. Davis, James Mullikin, William Baker and Clara Davis. The purpose of the company is to manufacture and sell artificial stone, concrete blocks and conduit pipes.

Consul Roger S. Greene reports that the Onoda Cement Company, of Japan, which has large works at Tokuyama, Yamaguchi prefecture, has received a grant of 1,488 acres of land at Paotzukai in the Kwantung leased territory, about seven miles from Dalny, for the purpose of establishing a large cement factory, the details being as follows:

Suitable limestone is found in that region, but the clay is to be brought from the neighborhood of Pulantien, about forty miles further north. A cement of the same grade as that now made in Japan is to be turned out. It is understood that the company plans to invest about \$498,000 gold in this enterprise, and that the works when completed are to have a capacity of 1,000,000 barrels a year.

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Reinforced Concrete. By A. W. Buel and C. S. Hill. Second Edition, 500 pages, 340 illustrations. Price, \$5.00.
A mathematical discussion and practical consideration of construction in reinforced concrete.

Reinforced Concrete. By Charles F. Marsh and William Dunn. (English). Third Edition, 660 quarto pages, 617 illustrations. Price, \$7.00.
A theoretical and practical discussion of concrete structures.

Architects' and Engineers' Handbook of Reinforced Concrete Construction. By L. J. Mensch, 217 pages, 172 illustrations, many tables. Price, \$2.00.
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Concrete Steel. A treatise on the theory and practice of reinforced concrete construction. By W. N. Twelvetrees. (English), 230 pages, 73 illustrations. Price, \$1.90. New Edition, ready shortly.

Graphical Handbook for Reinforced Concrete Design. By John Hawkesworth, C. E. Quarto, 70 pages, 15 large folding plates. Price, \$2.50.

Brayton-Standards for the Uniform Design of Reinforced Concrete. By Louis F. Brayton. Second Edition. Leather, pocketbook size. 110 pages. Illustrated. Price, \$3.00.

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Experimental Researches Upon the Constitution of Hydraulic Mortars. By H. Le Chatelier. Translated by Joseph L. Mack. 128 pages. Price, \$2.00.
A chemical and mineralogical study of cement composition.

Practical Cement Testing. By W. Purves Taylor, Engineer in charge Philadelphia Municipal Testing Laboratories, 315 pages, 142 illustrations, 58 tables. Price, \$3.00.

Portland Cement—Composition, Raw Materials, Manufacture, Testing and Analysis. By Richard K. Meade, B. S. 385 pages, 100 illustrations. Price, \$3.50.

Principles of Reinforced Concrete Construction. By Turneure & Maurer. Svo, viii + 317 pages. Cloth, \$3.00.

Hollow Concrete Block Building Construction. By Spencer B. Newberry. 25 pages, illustrated. Price, 50 cents.

Concrete Steel Buildings. By W. Noble Twelvetrees. (English) 420 pages, many illustrations. Price, \$3.75.

Field System. By Frank B. Gilbreth, 200 pages with illustrations, bound in leather. Price, \$3.00.
Embodies scores of suggestions for economizing and for increasing the output of the men on the job.

Handbook of Cost Data. By Halbert P. Gillett. Flexible leather, 622 pages, illustrated. Price, \$4.00.
Contains an exhaustive analysis, with actual figures of the cost of concrete structures of all kinds.

Engineers' Pocketbook of Reinforced Concrete. By E. Lee Heidenreich. (In preparation.) Price, \$3.00.
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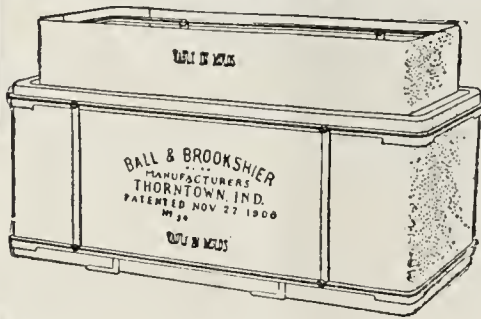
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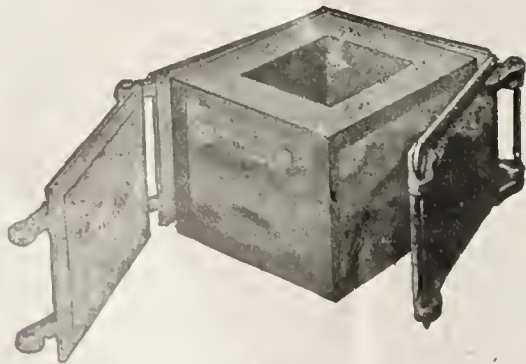
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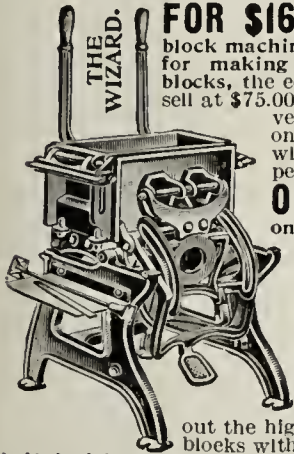
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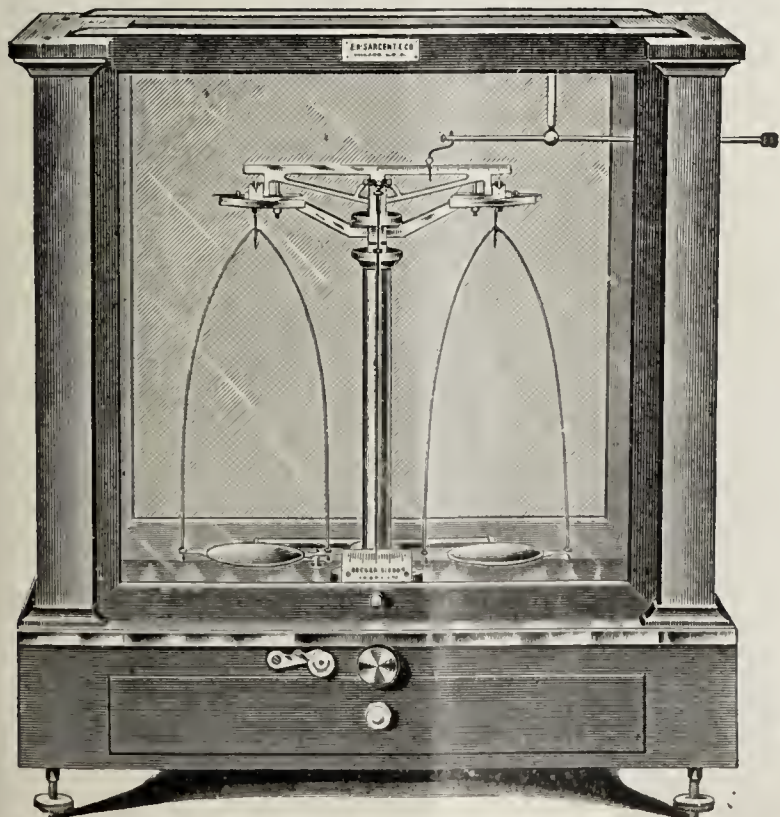


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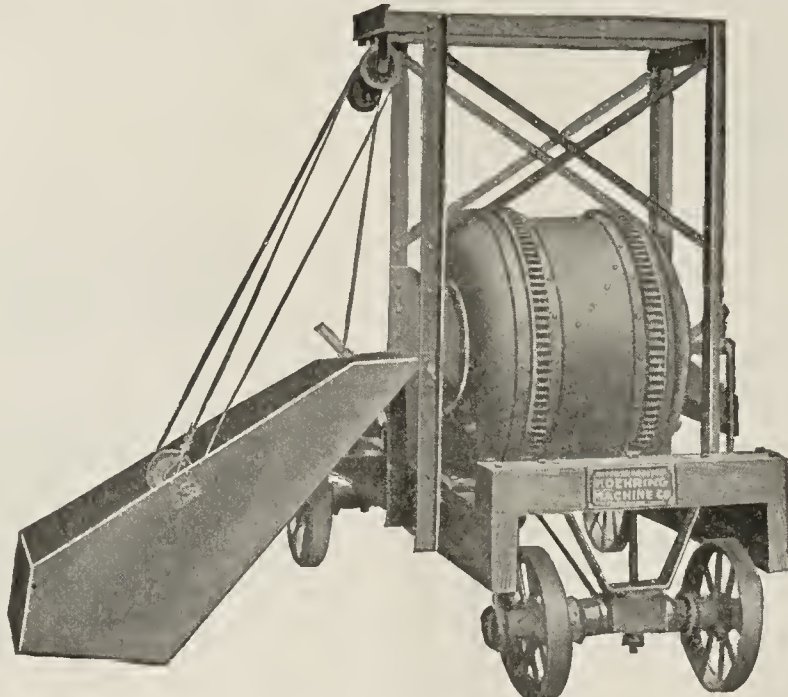
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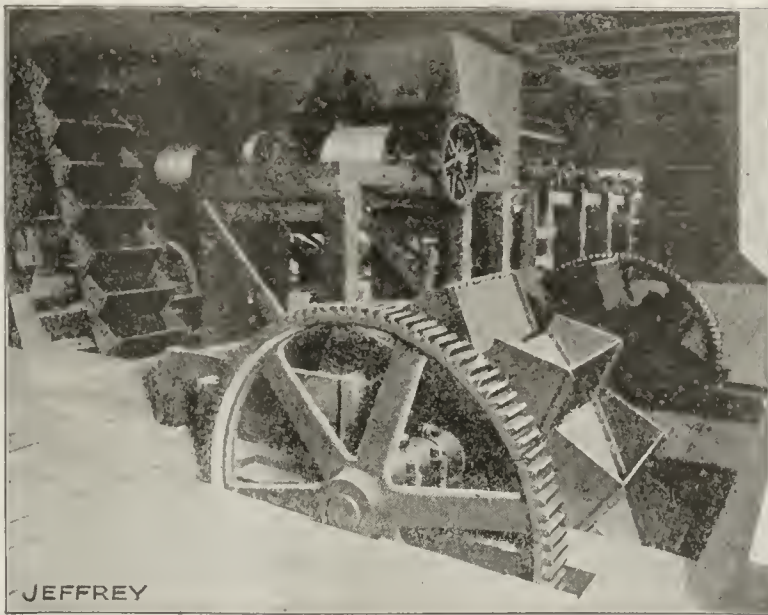
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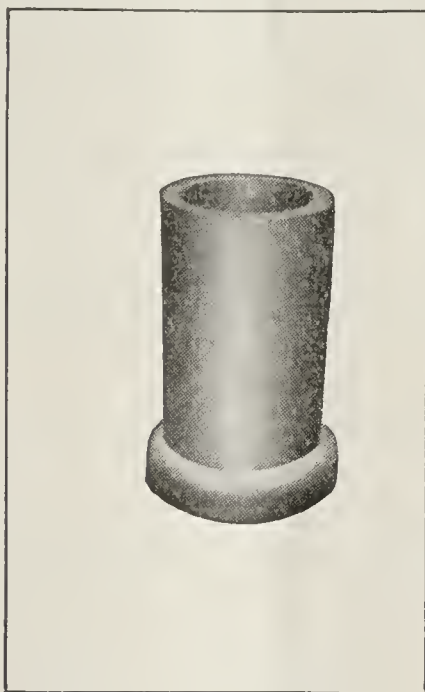
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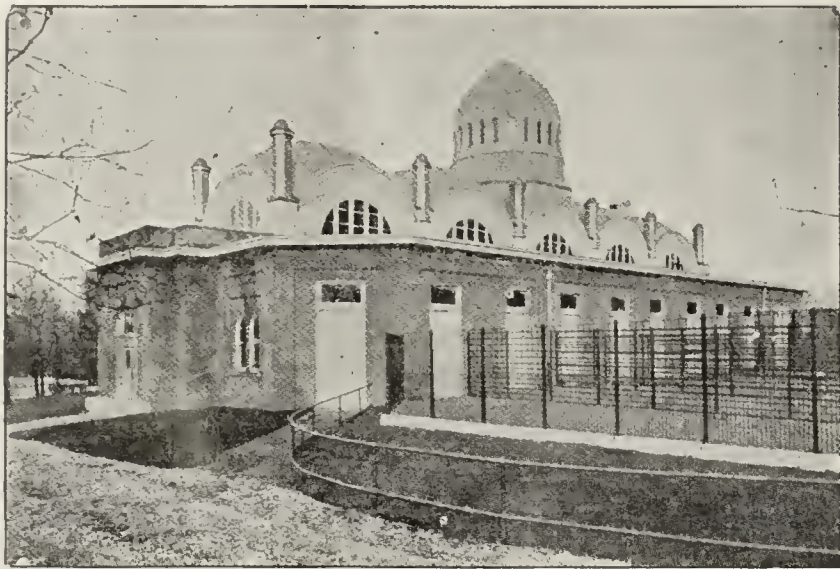
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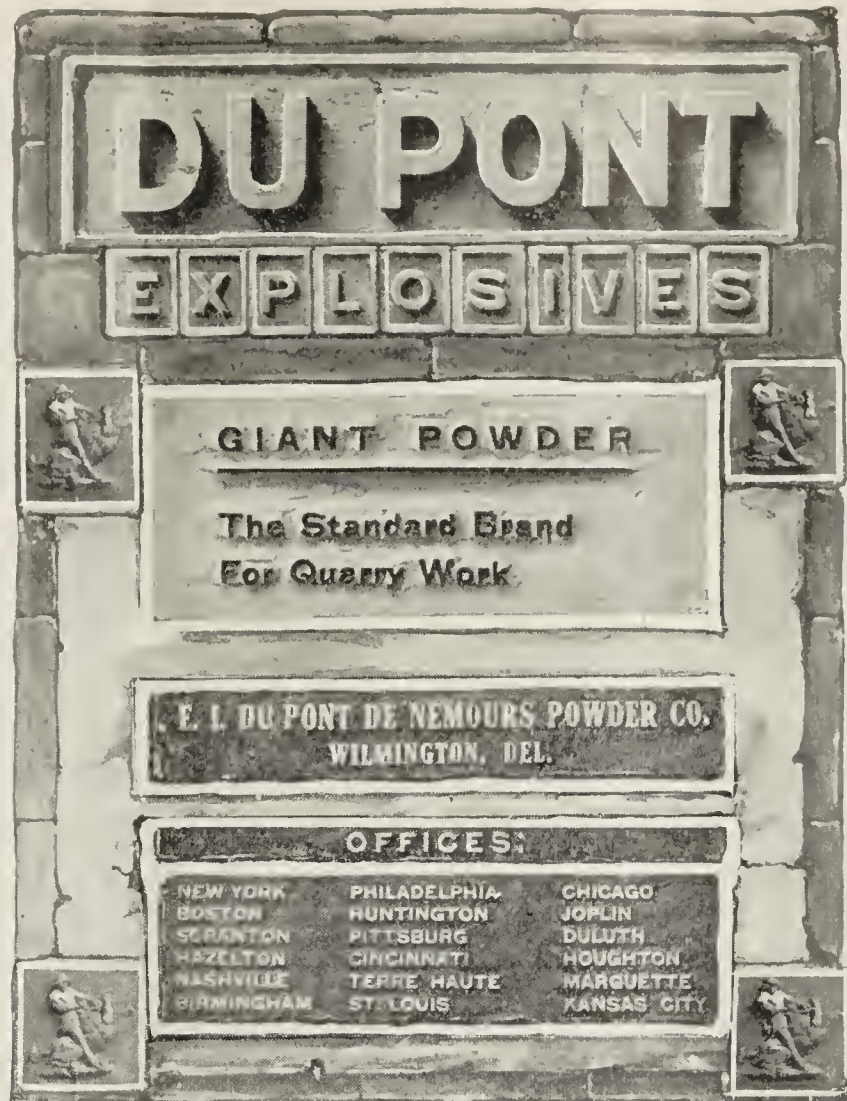


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MIDDLESEX HOLLOW CONCRETE BLDG. BLOCK CO.,
Per Mr. J. Dahmer, Treasurer.

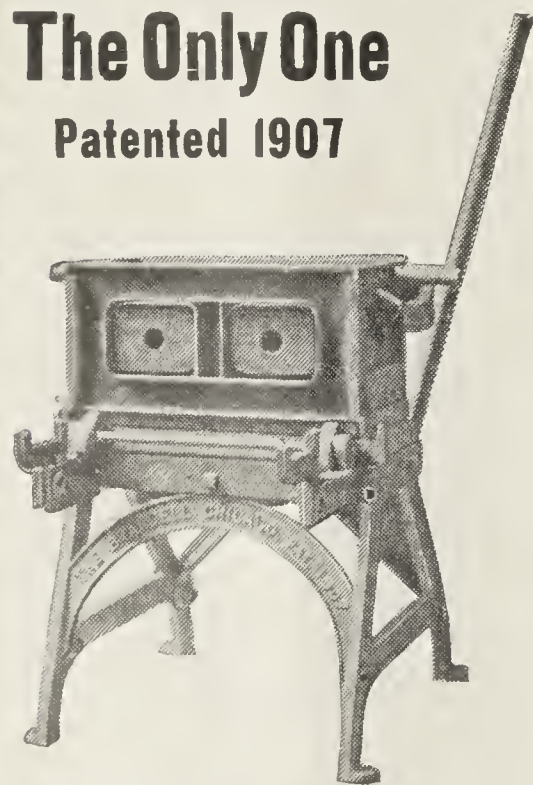
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CEMENT AND ENGINEERING NEWS

(PUBLISHED MONTHLY)

WILLIAM SEAFERT, Editor and Publisher

OFFICE—22 Fifth Avenue

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under Act of March 3d, 1879.

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Advertising Rates Sent on Application

JOHN F. WALDRON, Advertising Manager

CHICAGO, MAY, 1908.

CORRESPONDENCE.

We solicit correspondence on all matters of general interest to the cement trade in all its branches. Engineering notes, public improvements, and facts and opinions drawn from practical experiments will be welcome.

WASHING COAL TO LOWER THE ASH AND SULPHUR CONTENTS.

The United States government fuel testing plant at St. Louis, has been conducting tests on low grade coals which in their natural condition are unfit for steaming purposes on account of the high ash and sulphur contents. It was found that washing some of these low grade coals, so reduced the percentage of ash and sulphur, as to make them available for cooking purposes. The washing process increases the percentage of fixed carbon and volatile matter by removing a portion of the ash and sulphur. The results of 101 regular washing tests and 12 special tests made, show an increase in moisture of from 10 to 30%, or reduction in ash of 20 to 30 per cent, and a reduction of sulphur of from 10 to 50 per cent.

For example: A raw coal containing 5.05 per cent of sulphur contained after washing 2.47 per cent, a removal of 55 per cent. The ash in a raw coal containing 42.56 per cent was reduced by washing to 29.67 per cent, a total removal of 65 per cent; that in a raw coal containing 15.72 per cent was reduced to 10.16 per cent, a total removal of 41 per cent; and that in a coal containing 9.81 per cent to 5.38 per cent, a removal of 59 per cent. The cost of washing coal in Germany is said to

range from less than 5 cents to 10 or 12 cents per ton; in the United States from 8 to 18 cents per ton.

If these tests were made on coals for cooking purposes why could not the washing of low grade coal be used for producing powdered coal for cement burning, especially when there is a coal shortage.

IRON-ORE CEMENT.

Now that the Panama Canal Commission has decided to use large amounts of iron-ore cement in the construction of the Panama Canal, a fact which we mentioned in our February editorial, a description of the properties of this cement, which is slowly but surely replacing Portland cement in marine construction in this country as well as abroad, becomes a timely subject.

A pamphlet published by the manufacturer of this cement, the Hemmoor Portland Cement Co., of Hamburg, Germany, describes in a very instructive manner the advantages of iron-ore cement over Portland cement and is supplemented by the report of the Royal Experiment Station at Berlin and the results of many additional experiments made at the Hemmoor cement works. The pamphlet itself is a summary of the conclusions arrived at through the elaborate tests which are tabulated in the supplements. In the following we confine ourselves to the publication of the descriptive pamphlet proper and wish to mention that we have a limited number of copies of the supplements which we shall gladly mail free of charge to parties sufficiently interested in this subject. From Supplement III we have selected a few of the many photographs which illustrate the rapid destruction which Portland cement undergoes when mixed with gypsum or when kept in sea water.

The pamphlet has been translated by Dr. W. Michaelis, Jr., upon the request of the Secretary of Commerce and Labor. Owing to this circumstance we are in a position to make our readers acquainted with its contents:

The injuries which the various kinds of Portland cement suffer in a greater or lesser degree through the action of sea water and which frequently lead to a complete destruction of the concrete, are undoubtedly due to two different causes. In the first place, chemical reactions may take place between

certain constituents of the cements and some of the salts contained in the sea water, and, on the other hand, mechanical influences, as for instance the impact of the waves, frost, grinding of sand and stone, varying pressure on account of the rise and fall of the tides, all work injury upon the cements submerged in sea water. In the following we will deal exclusively with the first-named kind of injurious factors, namely, with the chemical changes brought about by the salts dissolved in the sea water. We are justified in confining ourselves to the chemical action of the sea water for the reason that the mechanical influences are of little consequence as long as the strength of the cement is not impaired by chemical changes.

The phenomena to be observed with Portland cement during its setting and hardening are mainly due to an elimination of calcium hydrate, a process which most likely goes on as long as the cement increases in strength. The amount of lime given off is quite considerable. Lamine found 32 per cent of calcium oxide in a cement which was submerged in the Black Sea for more than fifteen years. (Le Ciment, 1901, page 111.) In the case of a cement continually exposed to the air, this free lime can combine with the carbonic acid of the atmosphere and form carbonate of lime, at least on the surface. But entirely different conditions prevail if the cement is submerged in sea water. In the latter case the free lime is acted upon by the magnesium chloride and magnesium sulphate of the sea water, under formation of magnesium hydrate and chloride of lime and sulphate of lime, two calcium salts soluble in water. If these reactions take place the consequence must be a decrease of calcium oxide in a cement acted upon by sea water if compared with the original percentage, while the amount of magnesia must increase. Every analysis of a cement exposed to sea water proves the correctness of this assumption. This fact has been already observed by Vicat in 1840 during the examination of a cement which after six months' submersion in sea water was found to be heavily damaged. The outside which was attacked by the sea water showed 10.40 per cent magnesium oxide and 19.33 per cent calcium oxide, while the interior, which was not impaired, contained 1.87 per cent magnesium oxide and 31.33 per cent calcium oxide.

If this process would go on con-

tinuously complete erosion of every cement mortar submerged in sea water would be the result. That this does not occur, is due to various causes. In the first place, only a part of the lime is attacked by the sea water, namely, only the lime which is eliminated during the hardening process, but not the calcium oxide which is chemically combined, for instance with silica. In the second place, the magnesium hydrate which is formed can, under favorable conditions, fill in the voids resulting from the washing away of the lime, thus checking further injurious action of the sea water. Lastly, the mortar becomes so dense after a comparatively short time owing to the quickly progressing hardening of Portland cement, that alone by this purely physical condition further penetration of the sea water is prevented, and hence substitution of lime by magnesium hydrate is made impossible.

It has been mentioned in the foregoing, that a part of the lime eliminated during the hardening process combines with the sulphuric acid of the magnesium sulphate of the sea water under formation of calcium sulphate, that is to say gypsum. The injurious effect of this salt upon cement mortars has become the subject of many investigations which we may sum up as follows:

It is commonly understood, that the excellent properties of Portland cement are due in a great measure to its high specific gravity and consequently to the density of the Portland cement mortar. However, this great density is of no avail, if the hardening of these mortars goes on in sea water, because the formation of gypsum may lead to serious injuries to the concrete. Calcium sulphate crystallizes with two molecules of water under increase of volume; this process of crystallization, therefore, causes distention of the mortar as soon as the percentage of gypsum becomes too high; the consequence of this is a "blowing" cement.

Another grave danger to which the presence of gypsum may lead is its tendency to combine with calcium aluminates. In dry powdered Portland cement the lime is chemically combined with silica, alumina and iron and forms calcium silicates, calcium aluminates and calcium ferrites. Whether or not free calcium oxide be present and in what amounts, is still an open question. Landrin (*Tonindustrie-Zeitung*, 1882, page 177), who made a thorough study of the calcium aluminates and compared the pure

compounds with Portland cements manufactured at Argenteuil, came to the conclusion that these compounds occur in varying amounts in cements. He considered these aluminates to be especially detrimental constituents of the cements and attributed the greater or lesser resistance of the mortars against

sea water to a lower or higher percentage of calcium aluminates.

The most noteworthy treatises upon this subject, and of a more recent date, are the publications of Michaelis (1895), and of LeChâtelier (1900). Michaelis covers in his paper, "The Behavior of Hydraulic Cement In Sea Water," the



Pats showing disintegration of Portland cement caused by an admixture of gypsum.

All cements were mixed with 5% of gypsum and submerged in fresh water for 17 days.

No. 4994. Iron-ore cement. Perfectly sound.

No. 4992. A Portland cement containing 12.71% alumina. Completely destroyed.

No. 5000. A Portland cement containing 7.41% alumina. Soft, fissured, partly disintegrated.

No. 4997. A Portland cement containing 6.47% alumina. Fissured, edges begin to scale off.

No. 4991. A Portland cement containing 6.13% alumina. Soft, deep cracks, edges partly disintegrated.



Admixture of 13% of gypsum. Pats submerged in fresh water for 15 days.

No. 5030. Iron-ore cement. Perfectly sound.

No. 5028. Portland cement containing 12.71% alumina. Deep fissures; edges broken off.

No. 5036. Portland cement containing 7.41% alumina. Soft; partly disintegrated.

No. 5033. Portland cement containing 6.47% alumina. Fissures; edges worn off.

No. 5027. Portland cement containing 6.13% alumina. Beginning disintegration.

results of Candlot's, Michaelis' and LeChatelier's experiments, and explains the destructions which Portland cements suffer by the influence of solutions containing sulphuric acid salts, which likewise applies to sea water, to be due to the formation of a double salt composed of calcium aluminate and gypsum. This sulpho-aluminate, $\text{Al}_2\text{O}_3 \cdot 3\text{CaO} - 3\text{CaSO}_4$, is said to crystallize with 30 molecules of water, which process must necessarily be accompanied by an extraordinary power of distension. A similar process of crystallization would not only decrease the strength of the concrete, but would also expose new particles to the action of the sea water, so that finally through combined action of these processes a total destruction of the mortar would be made possible, and in fact numerous cases have been observed in which this condition existed and which terminated in complete destruction.

The calcium sulpho-aluminate has been obtained by Candlot, Michaelis and later by Schott (*Tonindustrie-Zeitung* 1896, page 838).

LeChatelier (*Le Ciment* 1901, pages 31 and 32) arrives through his experiments at the same conclusions as Michaelis; he states among other points the following: "The main cause, if not the sole cause, which cements suffer under the action of sea water is the formation of calcium sulpho-aluminate."

"The substitution of the clay by iron is beneficial from every point of view. The presence of gypsum alone does not cause disintegration of the cement. The power of resistance against mechanical influences of iron-cement* is far superior to that of alumina cements."

Rebuffat (*Le Ciment* 1901, page 68, and *Tonindustrie-Zeitung* 1901, page 272) has likewise made a careful study of the calcium aluminates. He admits the possibility of the formation of sulpho-aluminates from aluminates in the presence of calcium sulphate solutions, but is of the opinion that sea water would soon decompose the sulpho-aluminate. He allowed diluted and concentrated solutions of magnesium chloride and magnesium sulphate as well as mixtures of sodium

*That is to say, cements in which the alumina is wholly or partly replaced by iron oxide. The term "iron-cement" or "iron-ore cement" must not be confused with the term "iron Portland cement," a commercial name for a cement containing a high percentage of alumina and manufactured from blast furnace slag and limestone.



Admixture of 5% of gypsum. Pats submerged in sea water for 16 days.

- No. 4994. Iron-ore cement. Perfectly sound.
- No. 4992. Portland cement containing 12.71% alumina. Covered with a network of fissures.
- No. 5000. Portland cement containing 7.41% alumina. Edges broken off; softened completely.
- No. 4997. Portland cement containing 6.47% alumina. Beginning disintegration of the edges.
- No. 4991. Portland cement containing 6.13% alumina. Edges broken off and disintegrated.

chloride and magnesium sulphate to act upon sulpho-aluminate. According to his observation all these solutions quickly decomposed the calcium sulpho-aluminate. Calcium oxide and sulphuric acid went into solution, while a flocculent precipitate of alumina hydrate and magnesia hydrate (with a trace of calcium hydrate) remained. Only a saturated solution of magnesium sulphate formed an exception on account of its inability to dissolve

gypsum; it, therefore, acted very slowly. "Sea water," says Rebuffat, "decomposes sulpho-aluminate almost instantaneously; after a few hours nothing is left but a small amount of an amorphous flocculent substance, which is composed of alumina hydrate and magnesium hydrate with a small percentage of calcium oxide and sulphuric acid." Furthermore, Rebuffat studied the behavior of the aluminates free of sulphuric acid, towards solution of



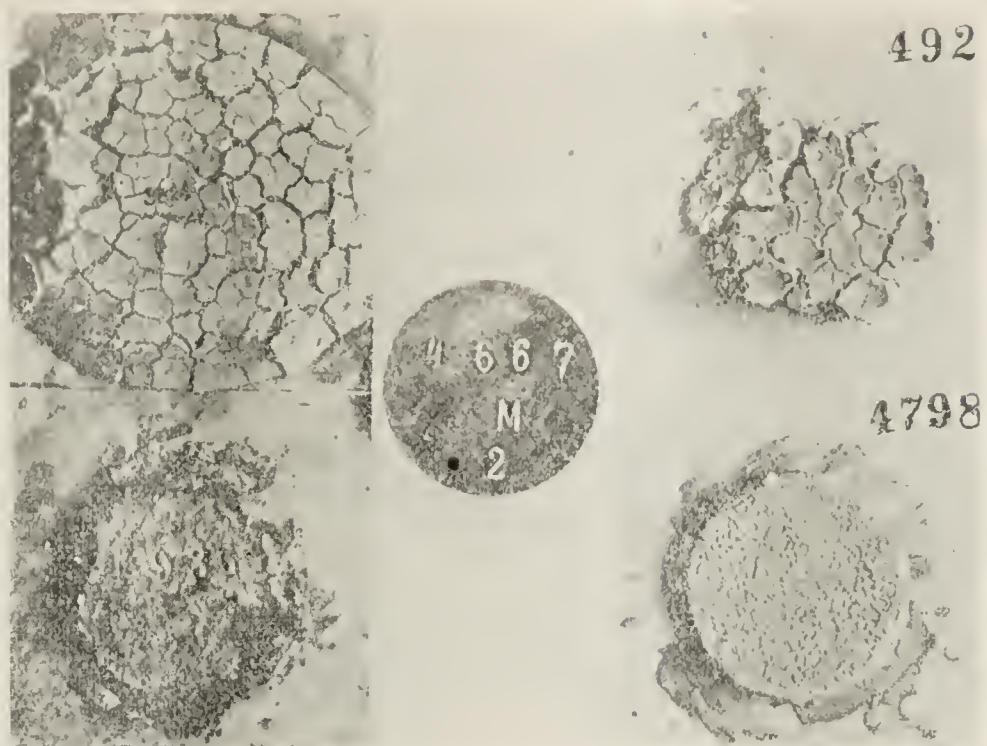
Effect of an admixture of 29% of gypsum. Pats submerged in fresh water for 26 days.

- No. 4924. Iron-ore cement. Perfectly sound. All Portland cements completely destroyed.

various salts and sea water. He arrives at the following conclusion: "In cement submerged in sea water, formation of sulpho-aluminate can not occur or at least only in very small amounts, and only temporarily. However, a fact so far overlooked has been revealed by these experiments, namely the destructive power of sodium chloride upon the aluminates as well as the sulpho-aluminates."

No matter which view we may take, either that of Michaelis and LeChatelier or the opposing view of Rebuffat, upon one point they all agree, namely that the alumina, or rather its compounds, the calcium aluminates, are the parts of a cement which are most easily acted upon by certain salts contained in the sea water.

The foregoing thought suggested the necessity of a partial or entire elimination of the alumina from the cements, and its substitution by compounds which were equally capable of forming hydraulic mortars. Similar attempts were made long ago, but without success. In 1854, for instance, an admixture of iron oxide to cements was recommended by Malaguti and Durocher with a view to aid the mortar to better resist sea water (Vicat, "The Latest Progress In the Clay and Cement Manufacture," page 131.) In 1873, Michaelis, and about at the same time Schott, demonstrated that the alumina of Portland cements could be replaced by iron oxide. Yet, also these experiments, were only of a theoretical interest at that time. For, in the manufacture of a cement, the alumina of which was almost entirely to be replaced by iron oxide, serious difficulties were encountered. For instance, a process of levigation of the raw materials was prohibitive on account of the high specific gravity of the iron-ores, which led to unmixing, of the raw materials. On the other hand, with the abandoning of clay, a great advantage of the latter was sacrificed, namely its plasticity, upon which all kiln systems in vogue at that time depended for the pressing of the raw mixture into brick or solid lumps which were placed into the kilns. Furthermore, the relations of the calcium sulphate, to the calcium aluminates, were not sufficiently known at that time. However, after the realization of the danger, which existed in the aluminates, in the presence of sulphate solutions, hence also in sea water, the results of these experiments of Michaelis and Schott had to be put into practical use; so much the more as after the introduction of the ro-



Effect of an admixture of 29% of gypsum. Pats submerged in sea water for 32 days.

No. 4667. Iron-ore cement. Perfectly sound. All Portland cements disintegrated.

tary kiln system, the unplasticity and lack of compactness, of the raw materials, proved no longer to be an obstacle in the manufacturing process.

Up to this time (February 1905) a great many experiments have been completed which were made under the same conditions with iron-ore cements, and, as a matter of comparison with Portland cements. In the following the results will be summarized, which the Royal Experiment Station of Charlottenburg, obtained with 2 iron-ore cements, and 3 Portland cements of different origin, which were all subjected to the same tests:

In supplement I, which accompanies this publication, and which contains the report of the Royal Experiment Station, the 2 iron-ore cements are designated with "G. M. I." and "W. B. 2," and the Port-

land cements which were subjected to the same tests with "3," "4" and "5." The composition of the latter proved them to be first class Portland cements. (The analyses are given on page 5, supplement I.) The essential difference between them and the 2 iron-ore cements consists in the percentage of alumina. While Portland cement "3" contains about 5% of alumina and the cements "4" and "5" approximately 8%, the percentage of alumina of the iron-ore cements amounts to 3.47% and 3.39%. This difference in the composition of the iron-ore cements necessarily results in a cement of a higher specific gravity than Portland cement, which in itself must be acknowledged to be a decided advantage, as high specific gravity, and great density of the mortar, which results from this, represent the greatest advantages of

IMPORTS OF CEMENT INTO THE UNITED STATES.

WHERE FROM	MARCH				NINE MONTHS ENDING MARCH			
	1907		1908		1907		1908	
	Quantity in lbs.	Value in Dollars.	Quantity in lbs.	Value in Dollars.	Quantity in lbs.	Value in Dollars.	Quantity in lbs.	Value in Dollars.
United Kingdom	25,610,776	\$87,664	20,167,188	\$89,836	218,709,640	\$709,418	169,058,955	\$629,328
Belgium	5,692,450	16,614	20,757,169	70,507	253,609,511	790,712	132,414,782	421,613
France	982,100	3,362	357,100	1,274	15,149,618	50,163	10,183,327	39,419
Germany	13,698,405	40,196	8,082,931	25,002	350,229,404	1,093,911	204,767,819	676,844
All Other Europe	400	3	40,728	177	20,097,670	57,829	3,891,128	13,465
British North Am.	400	3	40,728	177	3,104,285	22,663	275,740	1,624
Other Countries	430,400	2,345	198,414	929	54,708,737	258,454	5,705,947	30,055
TOTAL	46,414,511	150,184	49,603,530	187,525	913,608,863	2,985,150	526,267,648	1,812,348
Domestic Exports of Cement, bbls.	62,505	100,703	93,056	149,786	495,082	819,755	710,579	1,112,114

There were 18,689,896 lbs. of imported Roman and Portland Cement, etc., in the United States bonded warehouses in March, 1907, valued at \$54,273, against 24,174,343 lbs. in March, 1908, valued at \$91,524.

For nine months ending in March 30, 1907, there were 77,536 tons of asphaltum imported in the United States, valued at \$323,127, against 97,804 tons imported in nine months ending March, 1908, valued at \$379,298.

a hydraulic mortar. On page 4, of Supplement 1 the data giving the specific gravity will be found, and at the same place the figures showing the rise in temperature, during the setting of the cements, which is considerably lower with the iron-ore cements than with the 3 Portland cements. While the latter show a rise in temperature of 1.7, 2.5 and 2.5 centigrade, that of the iron-ore cements is 0.7 and 0.5, centigrade. The tests on constancy of volume, heating and boiling test as well as the fresh water test, (submersion in fresh water for 730 days, 24 hours after the moulding of the test pieces) have been passed equally well by all cements (page 5.) The tensile and compression strength tests of the test pieces made of iron-ore cement, which were kept in fresh water show good results. The compression strength tests deserve special mentioning. The mixtures 1 cement to 3 standard testing sand showed the following increase of the ratio between tensile strength and compression strength:

1:0.8 and 1:11.3 after 7 days.

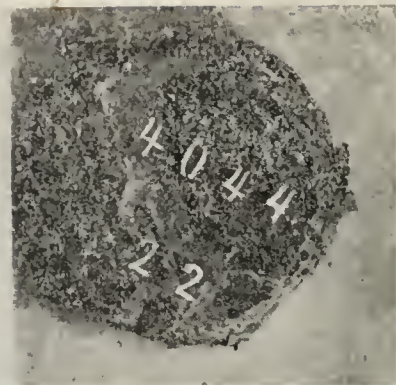
1:15.5 and 1:15.2 after 2 years.

The strength obtained with the iron-ore cements was found to be higher for sea water submersion than for fresh water. The two mortars composed of 1 iron-ore cement; 5 standard testing sand, showed after submersion in fresh water for 2 years:

A compression strength of 98.6 and 102.0 kg. per sq. cm. and, after submersion in fresh water for 25 days, and subsequent submersion in sea water for 702 days:

A compression strength of 122.6 and 119.2 kg. per sq. cm. (See pages 7 and 8, Supplement 1.) The state of preservation after this time was "perfect" according to the certificate of the Royal Experiment Station.

The superiority of iron-ore cement over Portland cement becomes only fully apparent when we subject them to the influence of sea water or of the salts contained in sea water, or when we mix them with gypsum. In order to examine the behavior of the 2 iron-ore cements and of the 3 Portland cements towards these salts, the Royal Experiment Station subjected mortars made of these cements in the proportions of 1 cement to 3 standard testing sand, and of 1 cement to 5 sand to the action of sea water of ordinary strength, and to solutions, which contained 3 times and 5 times the ordinary percentage of the salts contained in sea water. In addition to this, these three solutions were allowed to act upon test pieces



- Admixture of 9% of gypsum. Pats submerged in fresh water for 18 days.

This photograph illustrates the expansion which accompanies the disintegration of the Portland cements. Before submersion in water both pats were of the same size. The iron-ore cement (No. 4941) which has not been affected by the admixture of gypsum and consequent submersion has its original volume, while the Portland cement (with 7.41% alumina) considerably increased in volume.

which were composed of the 5 cements with an admixture of varying amounts of powdered unburnt (native) gypsum, of magnesium sulphate and of sodium sulphate. The percentage of native gypsum used for 4 series of experiments amounted to 5%, 9%, 20% and 33%. The admixture of magnesium sulphate were 5%, 9% and 13%; and that of sodium sulphate 5%, 9% and 20%. These elaborate tests, which were made partly with prisms partly with pats, plainly showed the superiority of iron-ore cement. The results of these experiments are given on page 10 and 11, of Supplement 1. The test pieces consisted of prisms made of all five cements: (1 cement: 3 sand and 1 cement: 5 sand) which were submerged in solutions containing the salts of sea water in normal proportions and in 3 times and 5 times these proportions. After 1 year, cement "5" (1 cement: 3 sand) was destroyed even in sea water of normal strength, while cement "4" (1 cement: 3 sand) disintegrated in the solution of threefold strength, and all Portland cements were found to be completely destroyed by the fivefold salt solution. Likewise all Portland cement mortars (1 cement: 3 sand) disintegrated in the threefold salt solution. All iron-ore cement mortars, however, remained intact, presented sharp edges and were free of cracks. Only the prisms composed of 1 cement: 5 sand were slightly warped in the solution of fivefold strength.

Hereafter follow the tests with cement pats made with an admixture of powdered gypsum, sulphate of magnesia and sodium sulphate in the proportions given in Supplement 1. All pats made in this manner of Portland cement "3" disintegrated after 1 year; those with high percentages of admixtures were-

completely destroyed after 3 months, while the pats with smaller amounts of salts showed fissures and scaling off. Out of ten test pieces of Portland cement "3" only four were not completely destroyed after 2 years, but these showed scales and cracks going fully to the center of the pats.

Of Portland cement "4" no test pieces remained after 15 months. All pats made with admixture of powdered gypsum completely disintegrated after 3 months. Of those made with admixtures of magnesium sulphate the pats containing 9% and 13% of magnesium sulphate were destroyed after 2 and 1 months respectively, while the pats containing 5% of magnesium sulphate lasted only 15 months. Also all pats made with sodium sulphate disintegrated within this time.

Of Portland cement "5" none of the test pieces remained intact after a period of 15 months. Of those made with gypsum the pats containing 5% lasted 12 months, those with more gypsum, however, only 2 months. Test pieces with 13% of magnesium sulphate disintegrated after 3 months. Test pieces with smaller amounts of magnesium sulphate and those containing sodium sulphate showed only slight signs of destruction after 1 year. After 15 months, however, all test pieces disintegrated.

The two iron-ore cements, on the other hand, showed a totally different behavior when subjected to the same tests. (See page 12 to 15, Supplement 1.) Of "G. M. I." 8 out of 10 test pieces remained fully intact after 1 year, namely all pieces made with admixture of gypsum and magnesium sulphate as well as those with 5% sodium sulphate. Only the outside of the test pieces with 9% and with 20% of sodium sulphate slightly scaled off

at this time (see page 13.) After a period of 2 years only 3 test pieces were slightly affected, namely those with 20% and 33% of gypsum and with 20% of sodium sulphate, while the remaining pieces showed a slight wear of the edges. The wear, however, was so inconsequential, that it was not worthy to take note of, and could not be compared in the least with the disintegration sustained by the Portland cements.

The iron-ore cement "W. B. 2." behaved in a very similar manner. After 1 year, the two pats with the highest percentage of gypsum as well as those with admixtures of magnesium sulphate showed scaling off of the surface: the edges of a test piece with 20% of sodium sulphate were slightly damaged. After 2 years, only two test pieces, namely those with 33% of gypsum and with 20% of sodium sulphate, showed softening of the surface, while the remaining pats showed slight signs of wearing or scaling off. (See page 14 & 15, Suppl. : I.)

The results of these experiments, which must be acknowledged to have been extraordinarily severe in many cases, may be summarized as follows:

Of the test pieces, which were made of cement and standard testing sand, only those made with iron-ore cement have passed all tests. After submersion in sea water of threefold concentration for 1 year, the prisms of iron-ore cement (1 cement; 3 sand) were in a perfect state of preservation from every point of view, while the prisms of the three Portland cements were destroyed. Of 30 test pieces made of the three Portland cements with admixtures of powdered gypsum, magnesium sulphate and sodium sulphate 14 disintegrated after a period of one year. Among the remaining 16 pats which made further observation possible there were only 5 which did not show severe damages. These 5 pats, however, and at the same time 4 more out of the 16 remaining test pieces completely disintegrated during the following 3 months. Another 3 pats disintegrated during the following 4 months, so that only 4 pieces remained which could be observed after 2 years: 3 of these showed cracks going fully to the center of the pats, while the last of them presented a heavily damaged and warped surface. (See page 16 & 17, Supplement 1.)

The pats made of iron-ore cement and subjected to the same tests were all intact after 2 years. The certificate of the Royal Experiment Station shows only 5 out of 20 test



Prisms made of cements with varying amounts of gypsum. Test pieces submerged in sea water of fivefold concentration.

All iron-ore cements are in perfect condition, while all Portland cements have been completely destroyed.

pieces not to be in perfect condition. These were designated as: "Surface slightly softened" (page 12-15); 2 of these 5 test pieces contained an admixture of 20% of sodium sulphate, 2 other pieces 33% and one 20% of gypsum.

The results of these comparative tests made at the Royal Experiment Station undoubtedly show the great superiority of iron-ore cement. The excellent behavior of the latter under the severest tests is to be explained alone by the substitution of alumina by iron oxide. The iron-ore cements submitted to the Experiment Station, however, still contained 3.47% of alumina (G.M.I.) and 3.39% of alumina (B.W.2.). These excellent results suggested further reduction of the contents of alumina. The Portland Cement Co. Hemmoor, therefore, manufactures iron-ore cement with a percentage of alumina as low as 1.5%. This small percentage of alumina is derived almost entirely from the ashes of ordinary fuel used for the burning. The cost of manufacture made it prohibitive to use a higher grade of coal, which would contain next to no ashes. The percentage of iron oxide in this cement is on an average 11.35%. As a result of this almost complete substi-

tution of the alumina by iron oxide the specific gravity of the cement is as high as 3.31, that is to say even higher than that of the iron-ore cements submitted to the Royal Experiment Station. In a previous paragraph we have called attention to the importance of a high specific gravity, upon which depends to a great extent the value of a cement.

Special mention deserves the behavior of the iron-ore cements of a small percentage of alumina in the presence of gypsum. It is well-known that an admixture of up to 2% of gypsum is made to cements with a view of retarding the setting time. With iron-ore cements such an admixture likewise serves to delay the beginning of the hardening process: the ultimate hardening, however, is considerably reduced. The test pieces without gypsum, for instance, could not be subjected to the boiling test after 24 hours, because they had not set sufficiently at that time. All test pieces with 2% of gypsum, on the other hand, could safely be boiled after 24 hours. Moreover, the strength of the mortar is favorably influenced by an admixture of gypsum. Supplement II contains curves illustrating the results obtained from tensile

strength tests. Although these tests are not complete as yet, they certainly show that the behavior of the iron-ore cements has been studied under widely varying conditions. In almost every case comparative tests were made with test pieces of iron-ore cement without gypsum and of the same cements with 2% of gypsum. For these tests neat cement was used as well as mixtures of 1 cement: 3 sand. The curves represent the results obtained with briquettes submerged in sea water and in fresh water and briquettes hardened in the air: furthermore, briquettes were tested which had been submitted to hot water tests. The test pieces for hardening in the air and those for hot water tests were partly gauged with sea water and partly with fresh water. As a matter of comparison, tests belonging one to another have been plotted on separate maps. Every one of these illustrations plainly shows that an admixture of 2% of gypsum has greatly increased the strength of the briquettes.

Attention was called to the fact, that the results obtained by the Royal Experiment Station plainly showed that the test pieces made of iron-ore cement which hardened in sea water gave a higher compression strength than those hardened in fresh water. This noteworthy phenomenon that the strength of iron-ore cement is very favorably influenced by sea water has likewise been observed throughout our experiments. The strength of the iron-ore cement mortars was not only found to be higher when submerged in sea water of normal concentration than when kept in fresh water; nor did the cement gauged with sea water yield superior results alone when hardened in the air or when subjected to hot water tests, nay, even the test pieces which for 140 days were submerged in sea water of fivefold concentration gave far superior results to those which for the same length of time were submerged in sea water of threefold strength. The curves of Supplement II illustrate this favorable action of sea water upon iron-ore cement.

We desire to add a brief discussion of the photographs given in Supplement III:

As the destructions caused by the presence of gypsum or by the action of sea water become visible only after a long time with some Portland cements, accelerated tests were made in order to compare iron-ore cement with Portland cements. In a manner similar to that adopted by the Royal Experiment Station, a

large number of test pieces were prepared with an admixture of varying amounts of gypsum. These were submerged in fresh water and sea water of normal strength and of threefold and fivefold concentration. For these tests Hemmoor iron-ore cement and a number of commercial Portland cements of good reputation were used. For each series of tests admixtures of the following percentages of gypsum were made: 2%, 5%, 13%, 20% and 29%.

Another set of tests was made in such a manner that prisms with admixtures of 9% and of 29% of gypsum were submerged in sea water of fivefold strength, and subjected to a pressure of 15 atmospheres at a medium temperature. This method of testing showed especially well the quick progress of the destruction after disintegration had once set in.

The photographs make very visible the superiority of iron-ore cement over Portland cement as regards their behavior towards solutions containing sulphates. Each photographic plate shows only test pieces which have been subjected to the same treatment and which contain the same percentage of gypsum. Moreover, as a matter of comparison, the photographs show, in addition to the test pieces made of the various Portland cements, the corresponding test piece of iron-ore cement. The photographs were taken in such a way, that the test pieces or the glass plates on which they rested were fastened to a board and, when fractured, were held in place by a number of bent pins. These pin impressions have been removed from the photographs so as to avoid misunderstandings. The white precipitate or coating on the test pieces, which were not acted upon by the solutions in which they were submerged, were also retouched.

The plates contain all necessary data as to admixtures of gypsum, the nature of the water in which the test pieces were submerged as well as the time of submersion, percentage of alumina of the various Portland cements and the characteristic features accompanying the destruction. The illustrations show that not one of the many test pieces made of iron-ore cement has suffered the least damage. Furthermore, will be seen from them, that many of the pats composed of Portland cement mortars considerably increased in volume. Plate XVI was especially made to show this increase in volume of a Portland cement.

Through our experiments we

arrive at the conclusion that the resistance of the Portland cements which we used for comparative tests depended upon two points, namely their method of manufacture and their percentage of alumina. Those made under the wet process invariably showed greater constancy of volume than those made under the dry process, supposing that the contents of alumina did not vary too much. The amount of alumina is without doubt the more decisive factor of the two. All experiments were a convincing evidence of the fact, that a cement disintegrates the sooner or suffers so much more serious damages within a given time the higher its contents of alumina. Portland cements low in alumina show greater resistance in the presence of gypsum or in sea water than those of a high percentage of alumina: but in the long run even the former go to destruction. Hemmoor iron-ore cement, as previously stated, passed the severest tests without the slightest damage; its contents of alumina never surpassed 1.5%.

All the foregoing statements warrant the declaration that well-burnt iron-ore cement is positively superior to Portland cement, if the cement is to be used for marine construction, for sea water canals and for all cases in which the concrete comes in contact with sulphuric acid salt solutions.

The Georgia Portland Cement & Slate Co., has been organized. The following officers have been elected: Pres. Dr. W. W. Wadsworth of Atlanta, Ga.; Sec. and Treas. H. H. Cabaniss, Atlanta; First Vice Pres., M. A. Pharr of Washington, Ga.; Second Vice Pres. W. M. Harris of Hampton, Ga. The directors are: J. W. Williams of Hartwell, Ga.; W. O. Jones, Elberton, Ga.; T. M. Green of Washington, Ga.

The plant of the Detroit & Aetna Cement Co., located at Fenton, was sold at Flint, Mich. on May 9th to satisfy a \$400,000 mortgage held by the Atlantic Trust Co., of New York, to John A. Myers, Boston, formerly treasurer of the Detroit Portland Cement Co. and a large bondholder, for \$130,000.

Myers says a new company will be formed in the east and the plant opened at once. It has been closed since December. Personal property as shown by the receiver is \$112,985.62. The sale was ordered by Judge Wisner in the circuit court, before whom the foreclosure proceedings were heard. Bond-holders get 45 cents on the dollar.

A REINFORCED CONCRETE BUILDING.

The accompanying photograph shows the Bostwick-Braun Co. building, at Toledo, Ohio, which has been going up at the remarkable speed of an acre of floor every day. It is reinforced concrete structure 220 feet square by eight stories in height and is to be used as a wholesale hardware house. The

from eleven to twelve feet center to center, which spacing is too close for economic column spacing. For that reason the columns were placed seventeen feet center to center on diagonal lines, thus bringing the columns about twenty-four feet center to center in the line of the shelving, leaving a twenty-four foot center to center in the outside walls,

adopted only after comparison with two designs by the architect's engineer, Mr. Geo. V. Rhines, on a common type and it was decided upon owing to the saving of approximately \$30,000, the smaller number of columns used, and the neater interior appearance and arrangement.

Mr. Geo. V. Rhines, engineer, Mr. Geo. S. Mills, architect, and



The Bostwick-Braun Co. Building, Toledo, Ohio. C. A. P. Turner, engineer,
Minneapolis.

lower floors are to be tested with 1,000 pounds per square foot. A novel arrangement of the columns was adopted in this building by the architect, Mr. Geo. S. Mills, of Toledo, Ohio; his arrangement securing the maximum economy of the construction adopted.

The general requirement in a wholesale hardware building is that the lines of shelves and boxing be

except on the river front. An adjustable cast form devised by Mr. C. A. P. Turner, Minneapolis, was used for the column heads so that this part of the centering is comparatively inexpensive. A. Bentley & Sons, of Toledo, are the architects for the building, and also represent the Turner System of reinforced concrete in that section of the country. The construction was

Mr. Thompson, manager of the company, all investigated buildings built on this system and were present at the time of the test of the John Hoffman Sons' Co. building, in Milwaukee, which was made of 1,000 pounds per square foot over a full panel. They had thus satisfied themselves both as to the strength and appearance of this type of building.

ORNAMENTAL CONCRETE WORK.

Rough concrete work can be seen in almost any town or village in this country, while really artistic concrete work has been rather scarce. Yet we have concrete manufacturers who can give artificial stone the artistic touch and natural appearance and finish of the natural stone. Our illustrations show what Julius Ruoff, of 3053 Rorer street, Philadelphia, Pa., is accomplishing in his well established business in concrete construction. Mr. Ruoff is a trained European concrete expert, familiar with every detail of his profession, as will be seen by the illustrations presented with this article. Fig. 1 on the front page shows a variety of good concrete ware and curbing suitable for decorating private grounds or a cemetery lot. Fig. 2 shows pedestal and flower vases, columns executed in imitation of granite or limestone in



Fig. 3.



Fig. 2.

an elaborately ornamented cemetery lot. Notice the sharp, clean cut lines and good taste in this work. Fig. 3 is executed in the same high grade finish. The pedestals with vine tracery could not be excelled; also the medallion with the woman's face in high relief. This is the class of work that Mr. Ruoff is pushing into the market at Philadelphia. Fig. 5 shows designs of pedestals and flower vases. Fig. 6 is an ornamental post. All of Mr. Ruoff's work is executed in either porous or water-proof cement, molded in either iron, wood, or plaster forms which can be used over and over again. Mr. Ruoff likewise does other construction work, such as asbestos fireproof floors with a composition for which he holds patents. Mr. Ruoff has a process for producing polished concrete work. All of these various processes are for sale. See advertisement in our advertising columns.

HIGH SPEED AUTOMOBILES DESTROY PUBLIC ROADS.

The U. S. Agricultural Department of Public Roads has investigated the damage done to public roads by high-speed automobiles and has issued a report on the subject from which we take the following:

"The modern fast-moving motor car is the greatest menace to macadam roads that has ever made its appearance. On some stretches of thoroughfare, especially in New England, where many broad and smooth roads have been constructed, the retrogression is not less than 40 per cent. If some plan is not



Fig. 5.

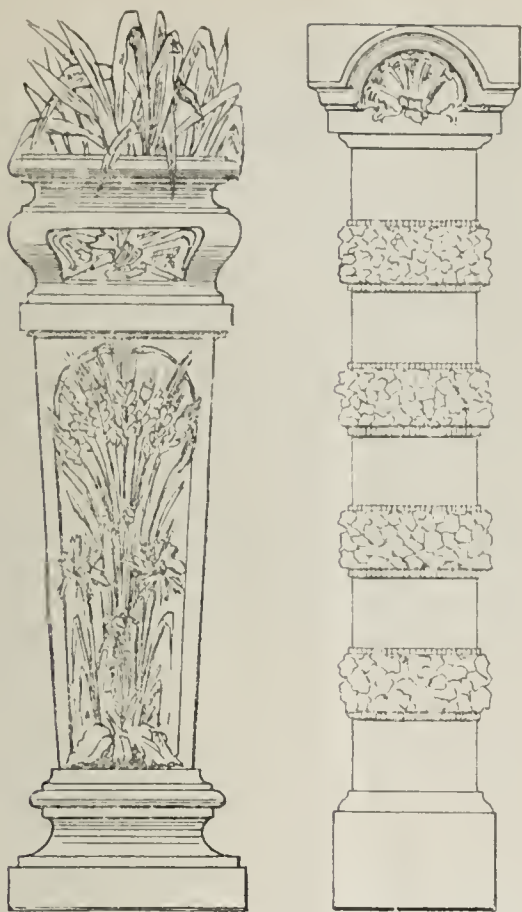


Fig. 6.

speedily devised for overcoming the bad effects the monetary loss will be stupendous and the good work of many years will go for naught."

The same condition exists in Europe. France has had the reputation of possessing the finest system of public roads in Europe, constructed and maintained by the government under specifications prepared by the officers of the Corps des Ponts et Chaussées. These specifications called frequently for repairs in proportion to the daily tonnage passing over such roads. These specifications are no longer applicable since the introduction of high-speed automobiles, which are doing more damage than the heavy freight traffic wagons of the past. In order to devise means to save the French roads a call for an international congress has been issued to meet at Paris October 11, 1908, to discuss the subject. The same conditions existing in France apply to other countries where the high-speed automobile is used. The only solution seems to be to use cement pavements, the same as is used on private automobile speedways, concrete being the only material that resists the destructive action of the modern automobile.

There is only one cement mill in Holland which produces less than 12,000 barrels per annum. The high price of coal and scarcity of lime stone restrict cement production in that country.

THE MANUFACTURE OF PLASTER OF PARIS OR STUCCO FROM GYPSUM ROCK.

By C. O. Bartlett.

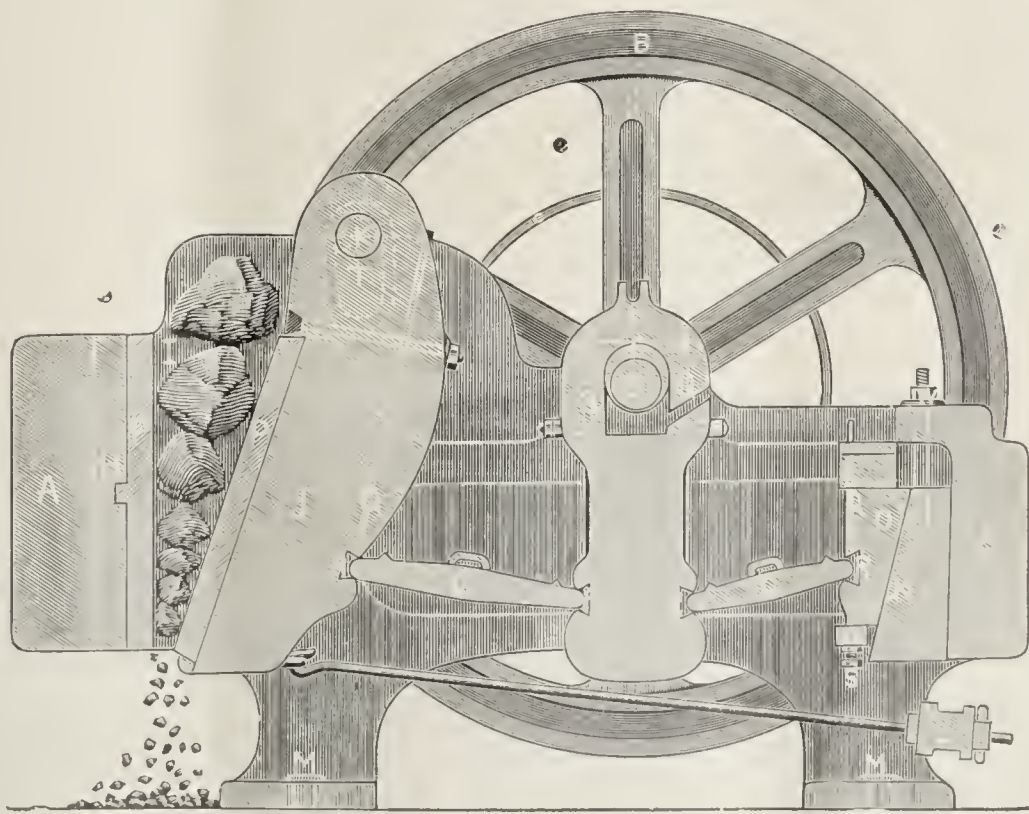
Gypsum rock is found in many States throughout the Union in large quantities and near the surface. It varies somewhat in color and considerably in hardness. The most of it is quite hard. It contains about 25 per cent moisture.

Plaster of Paris is generally called calcined plaster, and in this article the term calcined plaster will be used hereafter. The manufacture of calcined plaster has increased very rapidly during the last few years. It is the basis of all ready made plaster, and is used in the manufacture of Portland cement and in many other places. The demand for it is increasing rapidly. To manufacture this gypsum rock into calcined plaster, in quantities of fifty tons a day of ten hours, the following machinery, with weight, H. P., etc., is required:

The gypsum is first crushed in a jaw crusher (Fig. No. 1). The crusher has an opening 9 in. x 15 in., and will crush five tons an hour. It weighs 15,000 lbs. It requires 10 H. P. to drive it.

Weight of the dryer 21,000 lbs. It requires 8 H. P. to drive the dryer, including exhaust fan. This dryer should be erected in brickwork similar to a boiler. The products of the fire should not come in contact with the material on account of the danger of coloring it, if soft coal or wood is used as fuel. In some places, however, the products of the fire are allowed to come in contact with the material even when coal is used for fuel. Where this is done great care should be used in firing, and on general principles it is better not to have the fire come in contact with the material at all, if coal or wood is used as fuel. Any kind of fuel can be used, oil, gas, coke, wood or coal. Ten per cent of the moisture is taken out in the dryer. The dryer should have an automatic feeder.

From the dryer the crushed rock goes to the reel (Fig. No. 4), 36 in. in diameter and 12 ft. long, clothed with 24 mesh wire and $\frac{1}{4}$ mesh wire. That which passes through the 24 mesh goes to the bins over the kettle. The balance goes to the bins over the grinding mills (Fig. No. 5). Mills to have solid French buhr stones with iron frames. Stones are very heavy, 8 in. in thickness and 36 in. in diameter. Weight



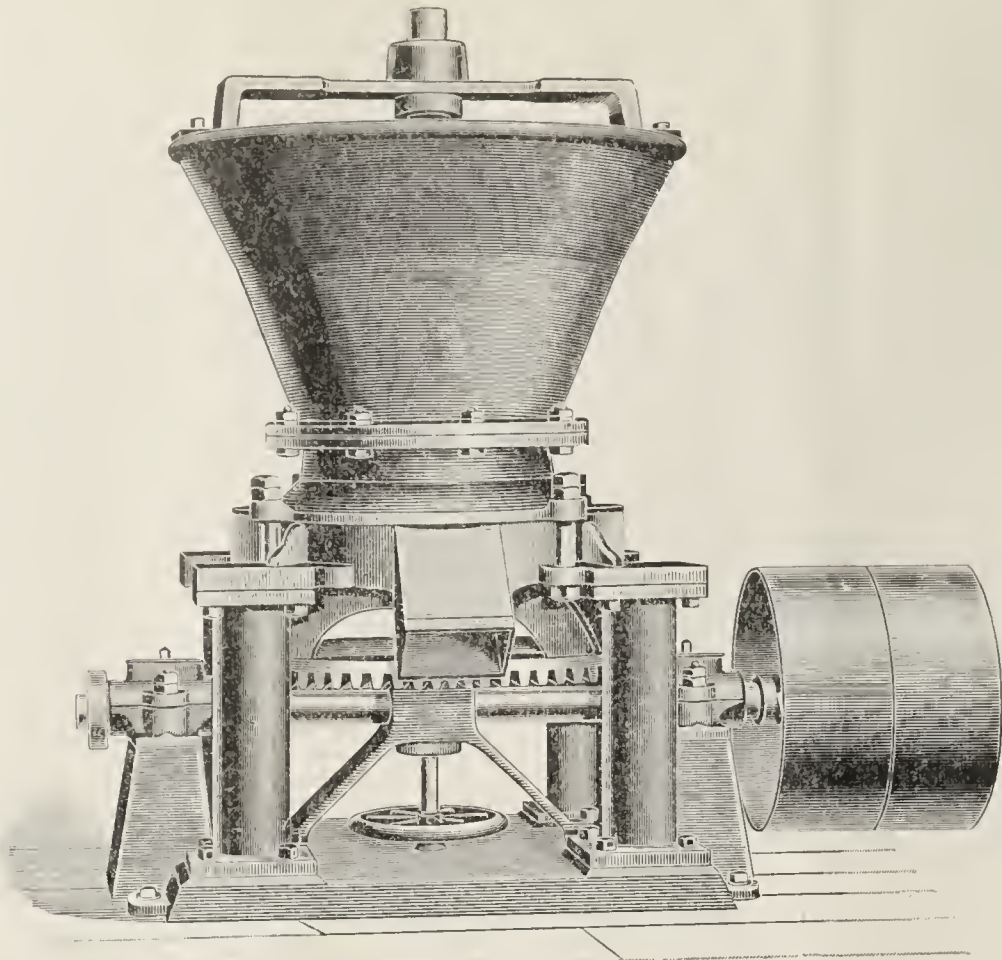
No. 1.

From this crusher the crushed gypsum rock goes to the second crusher, called a pot crusher (Fig. No. 2), and is again crushed. Weight of this crusher is 3,500 pounds. Power to drive it 10 H. P.

From the second crusher the material goes to the dryer (cut No. 3).

of the mills five tons. It requires 35 H. P. to drive them. The product from the stones should pass to bins over the kettle. The ground gypsum is now ready for boiling.

The boiling is done in a large kettle 10 ft. in diameter and 10 ft. deep (Fig. No. 6). Weight 10 tons. It



No. 2.

requires 25 H. P. to drive it. It is constructed as follows:

The ground gypsum is fed into the kettle and continually stirred and boiled until the balance of the free water is evaporated. It usually takes about two hours to boil one batch. It should be brought to a temperature not to exceed 265 degrees F. When properly boiled it will settle, and is ready to be discharged. This is done through a dis-

charge gate on the side near the bottom, said gate being operated with a lever from above. This is the first boiling or settling. A very large proportion of the calcined plaster is used in this form. If it is desired to make a firmer grade it is necessary to boil it the second time, which is in reality to take out the water of crystallization. If this water of crystallization is once started it must be taken out, otherwise the

calcined plaster will be spoiled. Therefore it is important not to get the temperature above 265 degrees in the first boiling, and from 390 to 395 in the second boiling. Considerable care must be taken with the boiling of the material, for here is where the chemical action takes place. After the material has been boiled it should be bolted again with a reel (Fig. No. 4) clothed with 40 mesh. The tilings from this reel should then be ground on a 24 in. French buhr mill (Fig. No. 7).

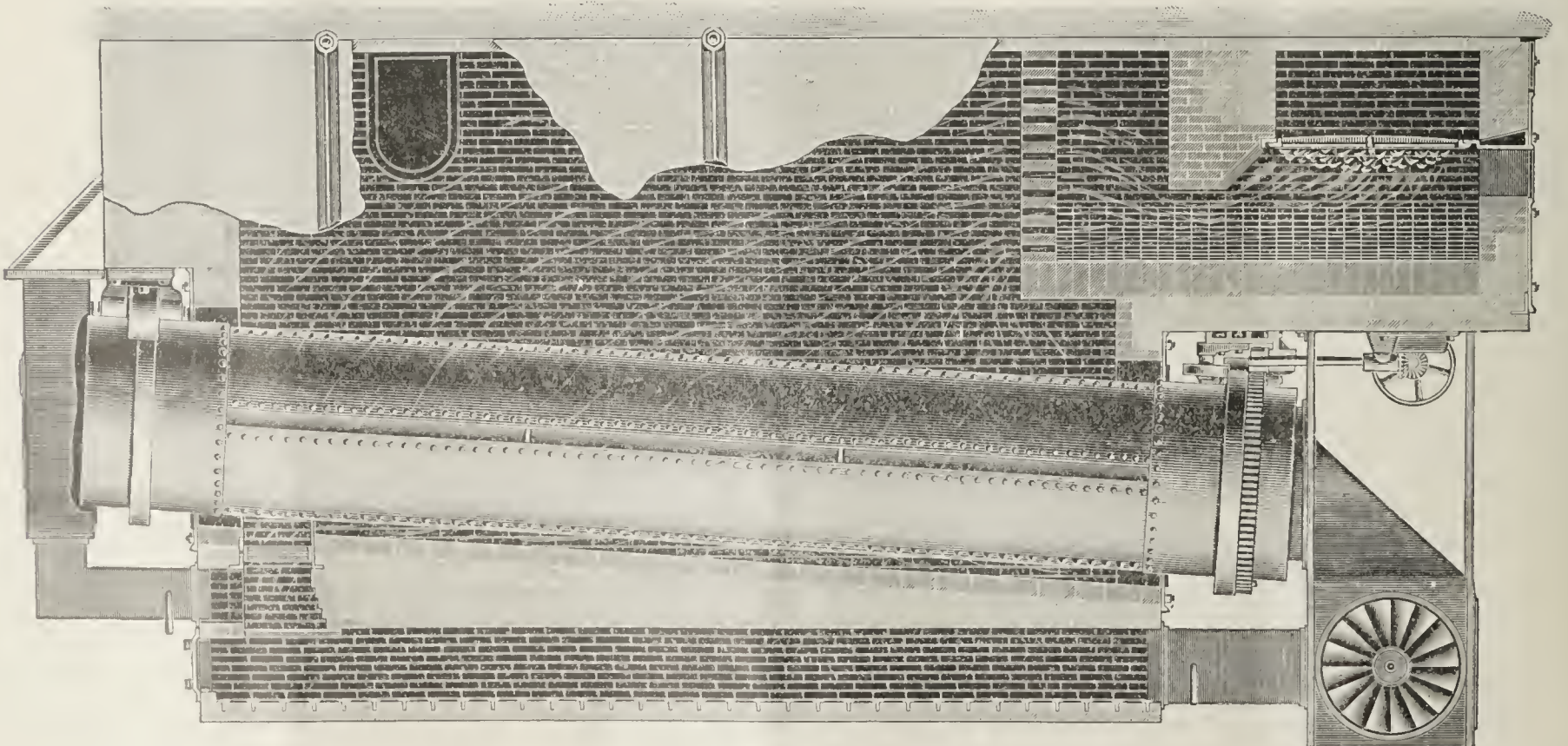
In addition to the above named machinery the necessary elevators, conveyors, shafting, belting, bins, etc., will be required. On account of the nature of the material the bins, conveyors and elevators should be made of steel, and elevators and conveyors should have steel casings. Estimated weight of elevators, conveyors, etc., 10 tons. Power to drive them 25 H. P.

To manufacture ready made plaster or ready mixed plaster the calcined plaster is used as the base. It is mixed with sand, hair and retarder, or wood fibre and retarder, in the following proportions for wall

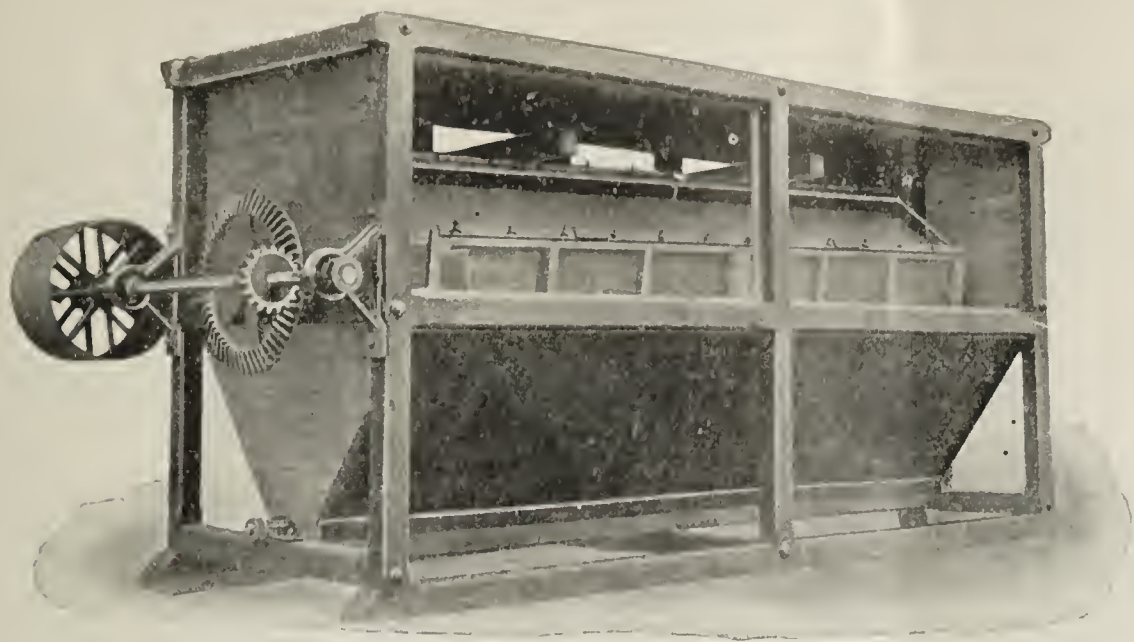
plaster:

Calcined plaster	300 lbs.
Goat hair (about	1 lb.
Dried sand	600 lbs.
Retarder, from 1½ to.....	2 lbs.

If desired hydrated lime can be used, and if so one-third as much hydrated lime as there is calcined plaster. Also about two pounds of asbestos fiber can be used to good advantage, and sometimes adds considerable to the working of it. For



No. 3.



No. 4.

sand mortar and brick walls 300 lbs. of calcined plaster and 900 pounds of dried sand is used; no hair is necessary. There must be either all calcined plaster and sand, or calcined plaster part and hydrated lime part and the balance sand, in proportion of one part calcined plaster to two parts of sand for lime mortar, and one part calcined plaster to two parts of sand for lime mortar, and one part calcined plaster to three parts sand in brick mortar.

Wood fiber is largely used for ready made plaster, and is one of the best fillers known in plaster work. It makes the plaster clastic, the weight of it is much less, and it also helps to make it sound proof and electricity proof. The following is a good formula when wood fiber is used:

Calcined plaster 600 lbs.
Clay 500 lbs.

Wood Fiber 40 lbs.
Retarder, from 3 to 5 lbs.

The color of the clay makes no particular difference, as a white coat usually follows. Some manufacturers use a low grade cement, and add as much as 200 lbs. of this to the above formula.

Wood fiber can be made of almost any kind of soft wood. It is made as follows: First, the wood is cut into lengths to suit the machine (cut No. 8), usually about 2 ft. long and about 24 in. in diameter. The block is placed in the carriage between centers and caused to revolve around the shortest diameter. The saws are set on a bias, and revolve very rapidly, so that instead of cutting directly into the wood they make it into fibrous material, each piece being $\frac{1}{2}$ in. to $1\frac{1}{2}$ in. long, according to the fineness of the material de-

sired. This machine weighs 2000 lbs. It requires 15 H. P. to run it.

The proportion of materials in making ready made plaster can be varied according the demand of the architect and the purpose for which it is used. Quite large quantities of hemp or old rope were formerly used, but are not used much at the present time. Calcined plaster is the base of all hard plaster, and without it hard plaster cannot well be made. The retarder is used to prevent the quick setting of the plaster. It retards it. This is manufactured in several places, and can be bought for \$45.00 a ton. In making a good quality of ready made plaster it is very important to either weigh or measure the material carefully. No guessing should be allowed. It is also very important to thoroughly mix the material, and the batch mixer is always recommended.

TRUST DEEDS ON CEMENT PLANT.

There was filed in the office of the clerk of Dallas County on May 1st a deed made by the Iola Portland Cement Company, conveying all of its property, including plant and equipment and tracts of land in Dallas, Tarrant and Limestone counties, to the Texas Portland Cement Company. The consideration named is "other consideration and \$1."

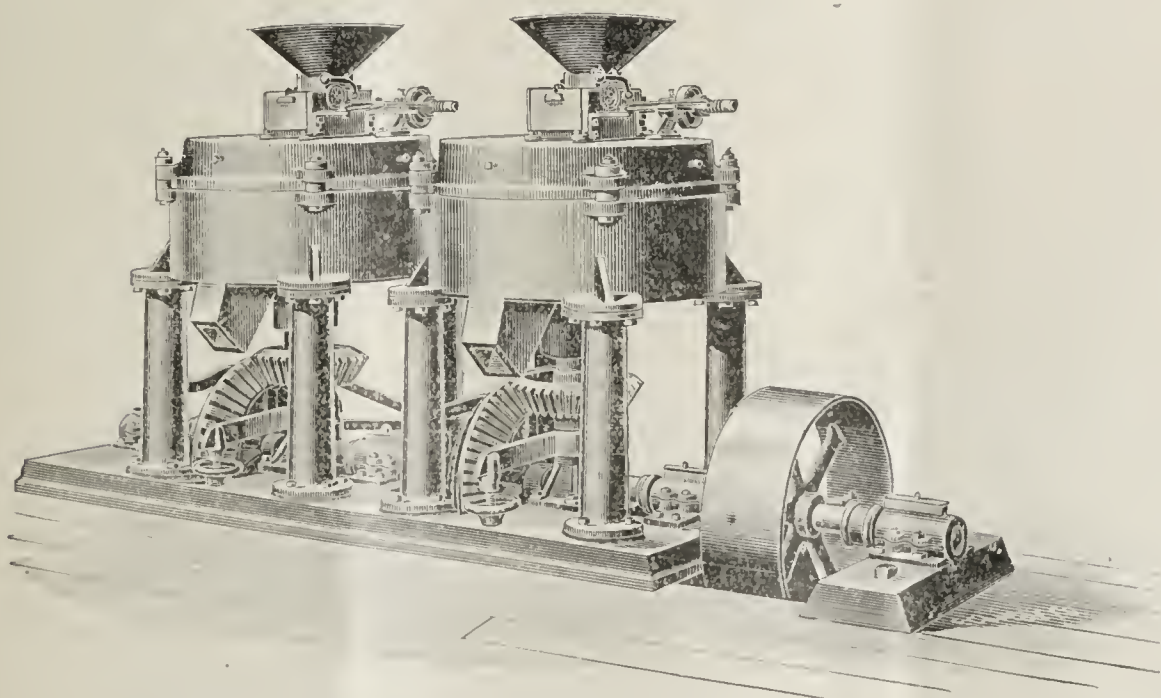
There was also filed a deed of trust by the Texas Portland Cement Company to the Commonwealth Trust Company of St. Louis, Mo., covering the plant and equipment of the Texas Portland Cement Company, to secure an issue of \$2,000,000, 6 per cent, twenty-year old bonds.

The Kosmos Portland Cement Co., has just been awarded a contract for 125,000 barrels of cement to be used in the dam of the Tennessee river near Chattanooga.

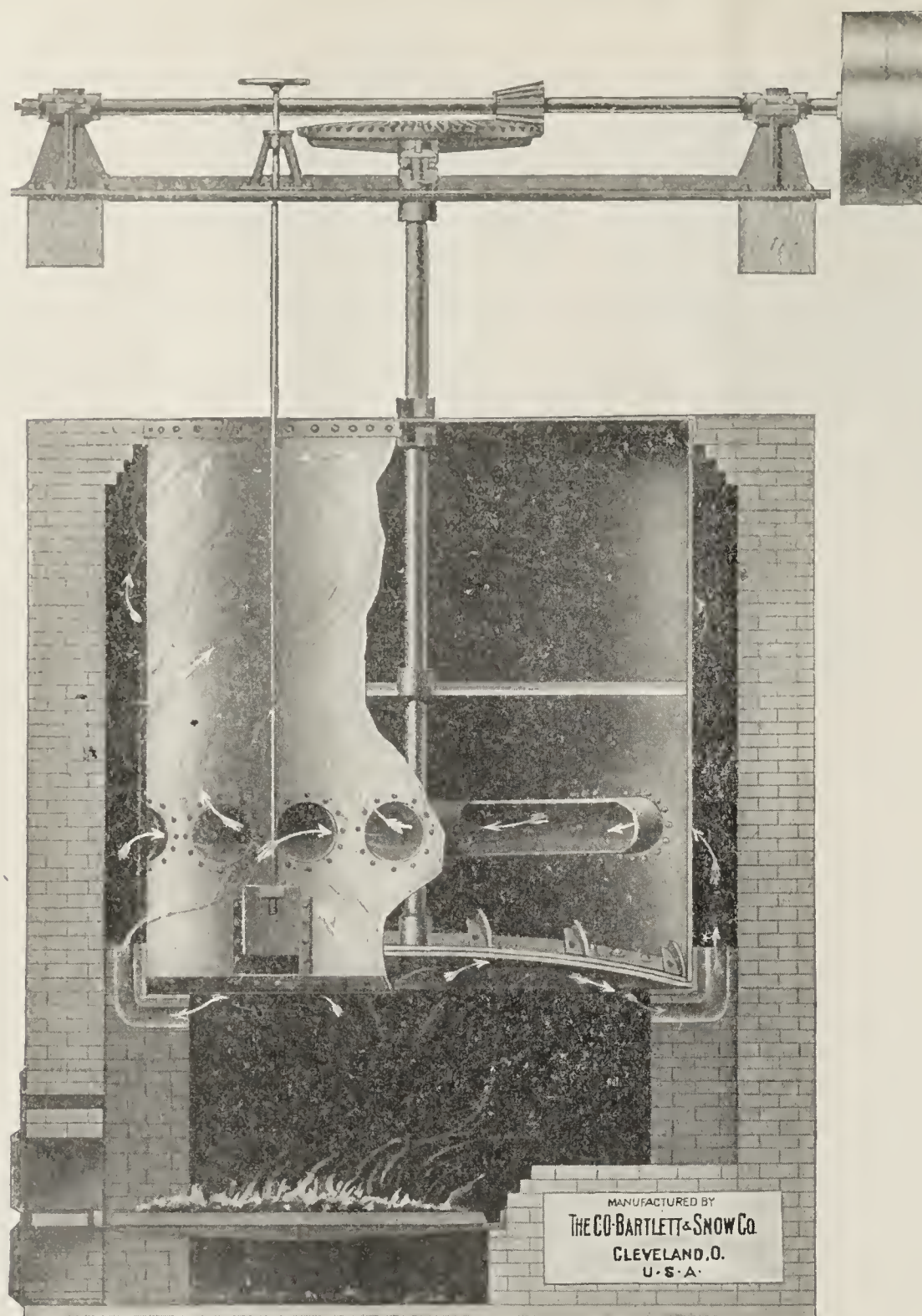
This is under the supervision of the United States Government and is one of the largest contracts that has ever been awarded for cement in the south.

The Transportation office of the U. S. reclamation service, E. T. Perkins agent, 777 Federal Building, Chicago, Ill., will hereafter have charge of the final settlements of all cement contracts for the reclamation service.

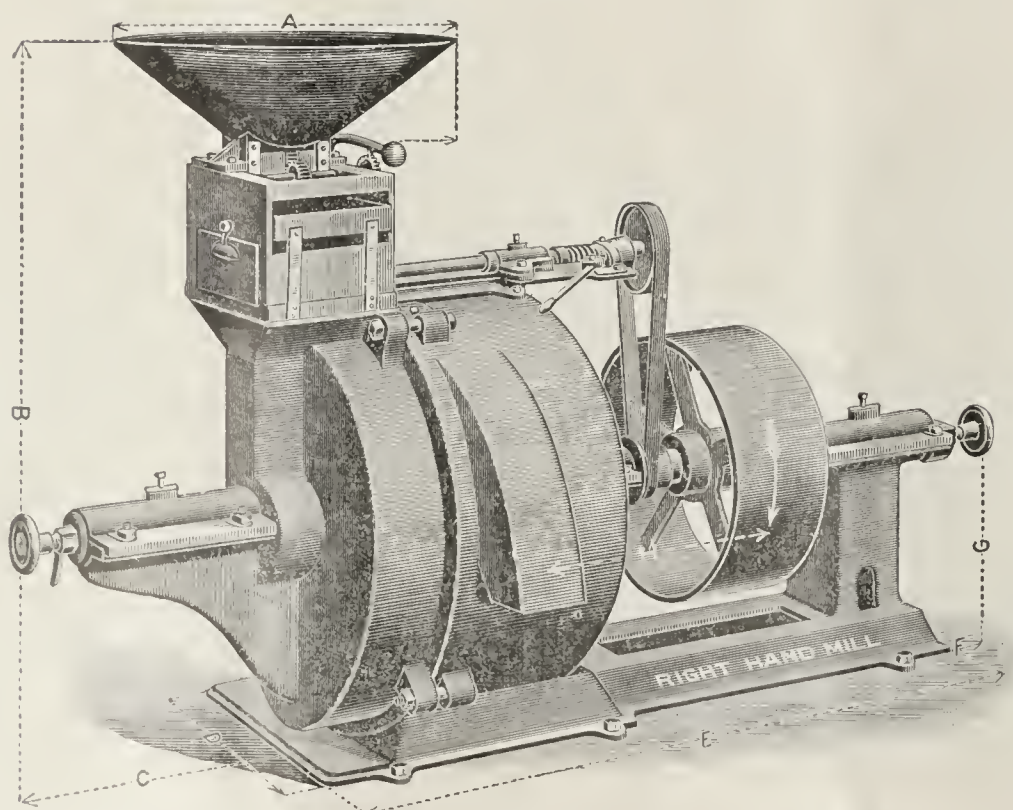
The office of the U. S. Reclamation service, cement expert J. G. Jewett in charge, has been changed from the Armour Institute to 207 Ellsworth building, 353 Dearborn street, Chicago, Ill.



No. 5.



No. 6.



No. 7.

REINFORCED CONCRETE SUPPORTS FOR MINES.

D. W. Shepard, of Denver, is placing upon the market a re-inforced concrete support for mines displacing the ordinary mine timbers. A factory is to be erected at Denver for the manufacture of these concrete mine supports.

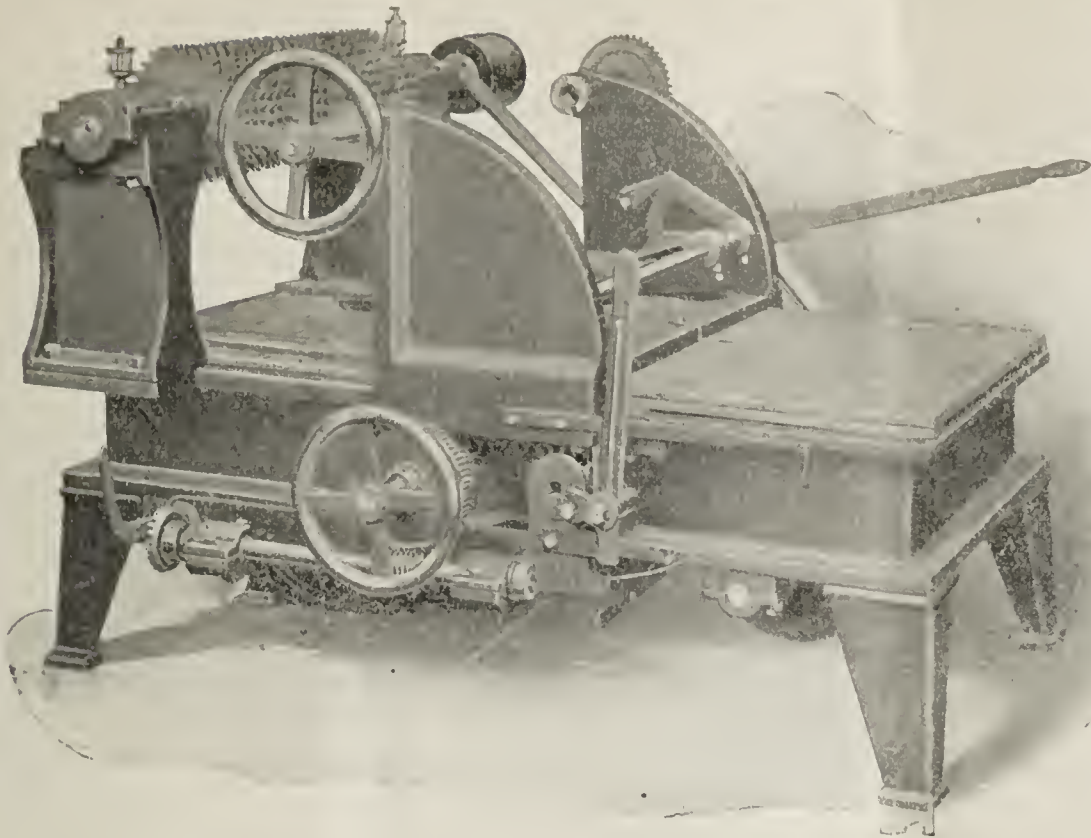
Mr. Shepard states that the cost of construction is from 10 to 15 per cent less than that of the ordinary timbers, when the latter are easily available. For an ordinary drift it sets 3 1-2 feet by 6 feet; the posts are made 4 inches by 5 inches in size and the caps are 4 inches by 7 inches. In these, a re-inforcing loop, made of one-half inch iron rod, is embedded. In the posts the rod extends above the upper end sufficiently to pass through a hole in each end of the cap. Nuts are screwed on the ends of these rods to hold the cap in place.

These supports can be manufactured directly at the mines, especially where the mines are located above the timber line, where the timber haul will be difficult and costly under these conditions. The molds in which the supports are formed as well as the sand gravel and cement and re-inforcing rods will be carried up the mountain sides by burros, trams or other available conveyances and the supports formed at the mine and erected in place safe against fire or deterioration from decay. 165,000,000 cubic feet of round mine timber was consumed in 1905 in the U. S., half of which was hard wood.

NATIONAL BRIDGE CO. OF INDIANAPOLIS, IND., CATALOGUE 146 PAGES.

This catalogue contains several hundred illustrations of bridges with plans, cross sections of work done under Daniel B. Luten patent, for re-inforced concrete bridges by the National Bridge Co., of Indianapolis. One of the interesting features of the Luten construction is tying the abutments together across the bed of the stream with steel ties to resist the thrust of the arch, by embedding these steel ties in a concrete pavement from abutment to abutment. Any one interested in re-inforced concrete bridge construction will find this catalogue a valuable acquisition.

The Great Northern Portland Cement Co. plant at Marlboro, Mich. was sold on May 5th by John S. Lawrence, Master in Chancery of the U. S. Court. Alfred Lucking of Detroit, representing the Union Trust Co., of Detroit, bid in the the plant for \$85,000. There were no other bids.



No. 8.

OKLAHOMA'S FIRST PORTLAND CEMENT PLANT AT DEWEY, OKLA.

The cut we publish shows the plant of the Dewey Portland Cement Co. at Dewey, Oklahoma. This is the first plant built in what was Indian Territory. There has been a great deal of activity in the cement business in the Southwest during recent years, on account of the advantage that comes from the

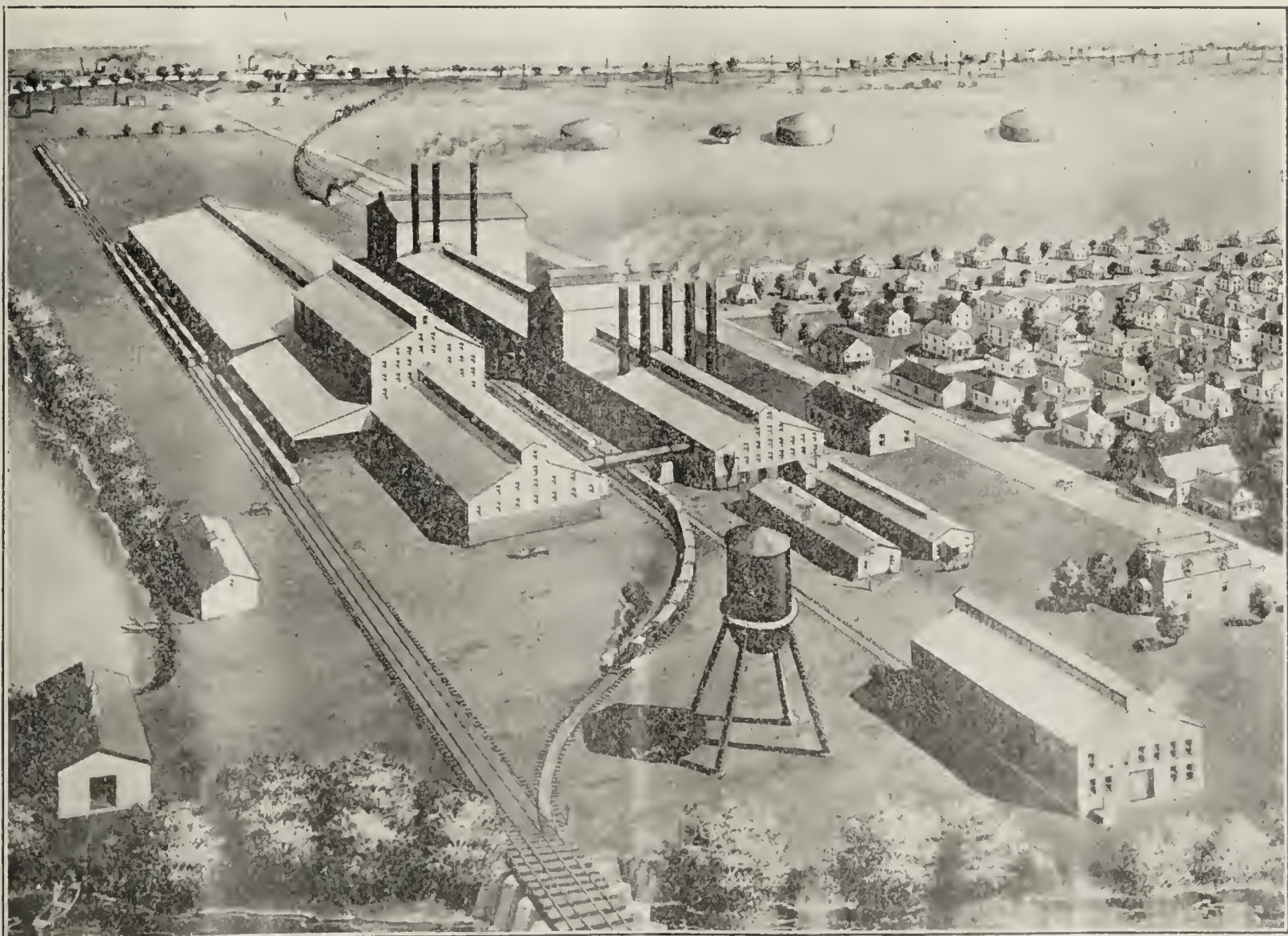
use of natural gas, which is abundant in that region. This advantage lies not only in the matter of cost, but in the matter of convenience.

The greatest items of cost in the manufacture of Portland cement are those of fuel and the handling of raw material. The Dewey plant has an advantage in both these items. It is located in a large gas field,

within a few miles of wells of 50,000,000 to 70,000,000 cubic feet daily capacity, and surrounded by wells of 20,000,000 to 30,000,000 cubic feet daily capacity. The company owns its own gas supply and has large pipe lines which assure a constant and reliable supply of fuel. In the matter of handling the raw material it is also well equipped, as there is a quarry of stratified limestone near at hand, with good drainage to the creek, so it is only a matter of quarrying the stone and transporting it to the crushers.

Everything is of Modern Design.

The rock after being blasted is handled by a large steam shovel, and transported to the crushers by ten-ton dump cars and oil-burning locomotives. The crusher is proportioned to the steam shovel so as to handle the largest rock that is likely to come from the quarry. This crusher is said to be the largest yet installed in a cement plant. The rock is further reduced by two No. 5 crushers and prepared for burning by hammer-mills and tube-mills. Five kilns, each 8x100 ft., are used for burning. The finish grinding is done by ball mills and tube mills. All of the machinery in the plant is driven by individual electric motors, thus securing a flexibility and



Dewey Portland Cement Co's Plant at Dewey, Okla.

reliability not possible with shaft-drives.

The power house is located at a distance from the cement plant proper and contains four large twin tandem double-acting gas engines, direct-connected to alternating current generators. This equipment assures reliable and continuous service, as three engines will handle the maximum load, leaving one engine and generator always in reserve.

The plant throughout is designed for continuous service and maximum output, each machine having its own individual motor and every step of the process of the manufacture being provided with a large storage capacity in the form of steel tanks or reinforced concrete bins.

The plant has good shipping facilities. It is located on the A. T. & S. F. and M. K. & T. systems and has direct track connections with both of these lines.

The capacity of the plant is 2,500 barrels daily, with provision for an increase to 3,500 barrels by the addition of grinding machinery, for which space is already provided.

General offices of the company are in the Scarritt building, Kansas City, Mo.; this point was selected because the plant expects to cover the entire territory west of the Mississippi river. The officers are: President and general manager, F. E. Tyler; vice-president and sales manager, F. L. Williamson; secretary, J. H. Keith; treasurer, J. R. Mulvane; traffic manager, C. D. Might.

A CEMENT COMPANY BARRED FROM THE U. S. MAILS.

The National Cement Company which has been promoting a scheme to build a cement plant at Carpentersville, Warren County, N. J., has been barred from the use of the U. S. Mails. This company has a New Jersey charter under date of May, 1907. The incorporators are Clarence L. Murphy, Pres.; Thomas E. Warman, Vice Pres.; J. K. Baillie, Sec.; Ralph W. Emerson, Treas.; and A. H. Bigelow, Supt. Capitalization \$2,000,000. No sooner had their charter been granted than the promoters proclaimed from street corners that they were about to effect a combine of 14 existing Lehigh cement plants. In our July, 1907, issue we stated that "the National Cement Co., without a plant or visible capital will make little headway in effecting such a combine, since projects which are proclaimed in advance from street corners usually begin and end in wind. Clear head-

ed financiers as a rule mature their projects before they take the public into their confidence." We sized this company up about right at its inception. The promoters of the enterprise were, mostly from Plainfield, with the exception of A. H. Bigelow, of Stewartsville, N. J., who was named as superintendent of construction. The promoters promised 500 per cent profit to prospective investors, while the farm upon which the plant was to be built belonged to one of the promoters and was mortgaged. Legitimate cement plant projects will not be injured by the government withdrawing the right to use the mails from the National Cement Company.

Iroquois Portland Cement Co., Caledonia, N. Y.; to manufacture cement and cement products; capital, \$10,000. Incorporators, William B. Dickinson, Erie Co., Savings Bank Building, Buffalo; George H. Kelley, No. 1898 East 73d street, Cleveland; James Parmalee, No. 60 Wall street, New York.

Kensington Concrete Construction Co., Brooklyn; to construct buildings, etc.; capital, \$5,000. Incorporations: Sylvester Annunziante, No. 1458 38th street; John J. Donlen, Jr., No. 327 80th street, both of Brooklyn.

A cement tile and brick plant will be built at Sheffield, Franklin Co., Iowa, to be known as The Sheffield Cement, Tile & Block Company, capital \$20,000, S. S. Sullivan, manager.

A. F. Meeker and others comprising the directory of the Gem City Concrete Company, of Dayton, Ohio., filed a petition in the Common Pleas Court, of Montgomery Co., on May 11th, through Thompson & Thompson, praying for a dissolution of the company.

The authorized capital stock of the company is \$115,000, divided into 2,230 shares. The estimated assets of the concern are \$35,366.50.

Contemporaneous with the action a note was brought against the concern by A. F. Meeker, through J. D. Miller, in which he asks for a judgment for \$146.91.

The Bonner Portland Cement Co. of Bonner Springs, Kansas, held its first annual meeting at Bonner Springs on April 28. The following officers were elected: W. H. Caffery, Pres., Kansas City, Mo.; Charles Knabb, Vice Pres. of Hiawatha, Kan.; A. L. Cooper, Sec.; J. D. Waters, Treas., Bonner

Springs, Kan. The Board of Directors are as follows:

John W. Breidenthal, banker, Kansas City, Kas.

J. D. Waters, banker, Bonner Springs, Kas.

A. L. Cooper, state senator for Missouri.

G. G. Gheen, president Gheen Tobacco company, Kansas City, Mo.

W. B. Richards, vice president Richards & Conover Hardware company, Kansas City, Mo.

Charles Knabb, banker, Hiawatha, Kas.

W. W. Cawkins, capitalist, Kansas City, Mo. Louis Graff, wholesale lumber dealer, Beatrice, Neb.

Charles H. Steefer, banker, McLouth, Kas., and C. C. McCarthy, banker, Nortonville, Kas.

The Association of American Portland cement manufacturers will issue a directory of the cement plants in the U. S. covering only the plants in actual operation. It will be ready by June 1st, price 75 cents.

Dr. Jean Robt. Moechel, chemical engineer, and Burton Lowther, civil engineer, have recently incorporated under the name of Moechel & Lowther Engineering Co., and have opened an office and laboratories at 1110-1112 Wyandotte St., Kansas City, Mo., for the practice of industrial engineering work and consultation. The laboratories will be equipped with the most modern apparatus for the trial burning of cement materials and fire clays, high temperature measurements, experimental work in producer gas and oil burning, tests of road and building materials, etc. This company will specialize in the design and consulting management of industrial plants and the utilization of by-products and sanitary work.

Dr. Moechel has for the past twelve years been identified with the great development of the cement industry of Missouri and Kansas, and the Southwest, and taken an active part in the development of metal and mineral properties, and municipal sanitation.

Mr. Lowther, the junior member of the firm, has been in charge of general construction and development work for large corporate interests in the Eastern and Western States.

The Southern States Cement Plant at Rockmart, Ga., started up May 7th after being shut down for several months.



It's ambition that distinguishes MAN from the lower animal. MAN'S natural tendency is to climb—to seek HIGHER LEVELS. If you are not advancing it is your own fault. Here is an opportunity for YOU NOW

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This cyclopedic fully covers the Standard Methods of Design as applied to Reinforced Concrete. It presents authentic formulas based on the theoretical analysis of the Beam Theory, and is strengthened by actual tests. These formulas are comprehensive, and are easy to apply. They give you a firm foundation on which to work and do away with the old time "hit or miss" theory methods, which have caused so much disaster. This work is the most comprehensive yet published on Reinforced Concrete, and is entirely authoritative from every point of view.

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In addition to the information on Reinforced Concrete, this work also contains over **200 plans of artistic moderate priced houses**—invaluable to anyone contemplating building or alterations. Also over **40 practical problems in construction with solutions.**

Hundreds of hints and suggestions to house builders and house owners in this work will save them many times its cost. The chapters on plumbing, heating, including furnace, steam, hot water, and exhaust steam—and ventilation are especially complete.

Free illustrated hand-book describing our course on Reinforced Concrete and over 60 other engineering courses will be sent on request.

BRIEF LIST OF CONTENTS

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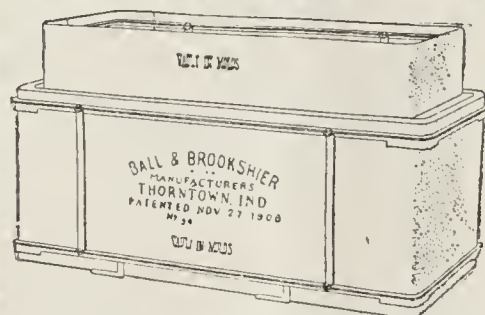
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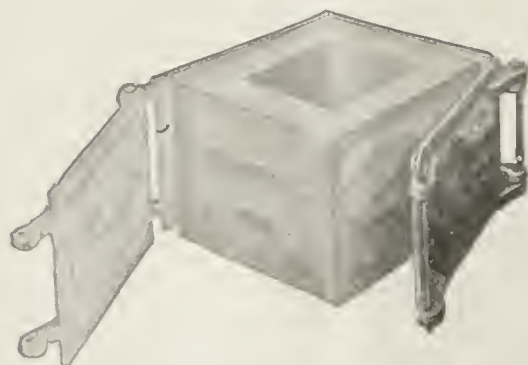
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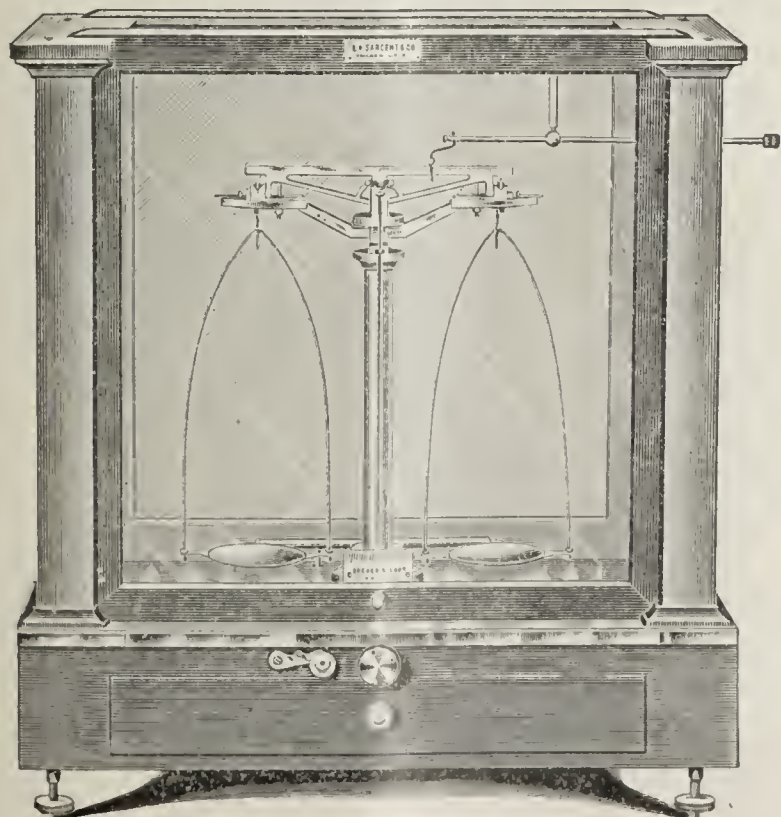
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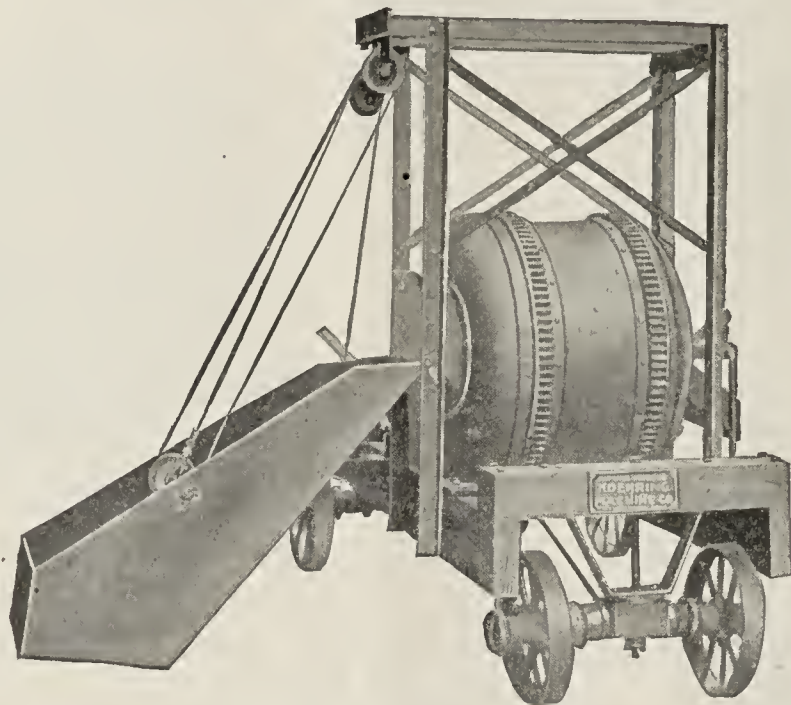
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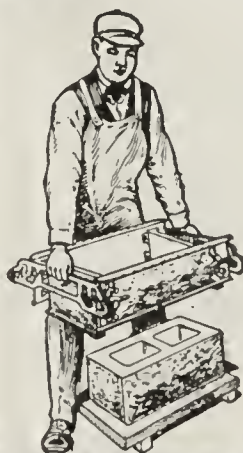
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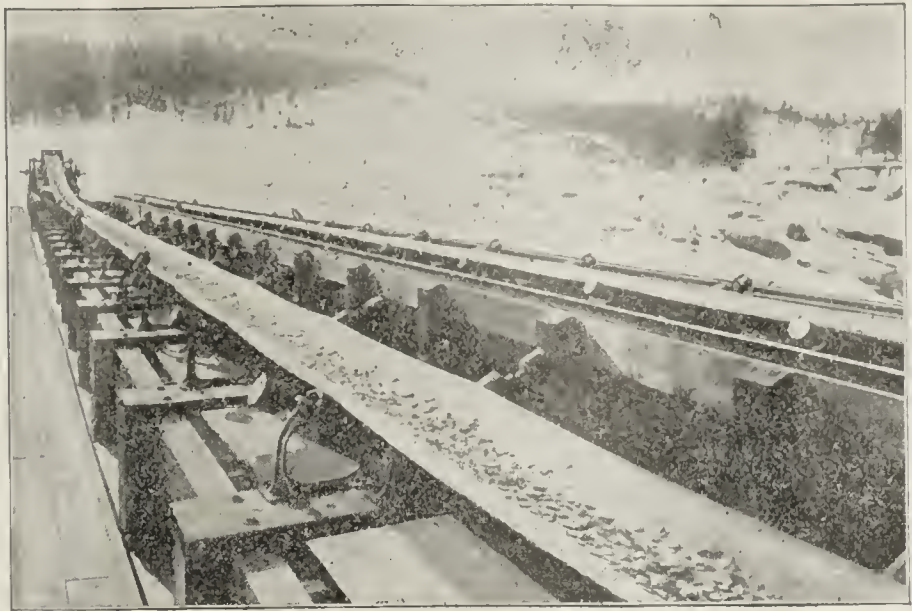
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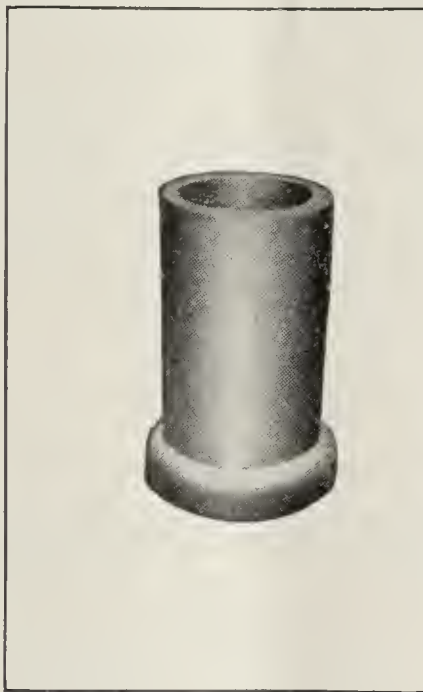
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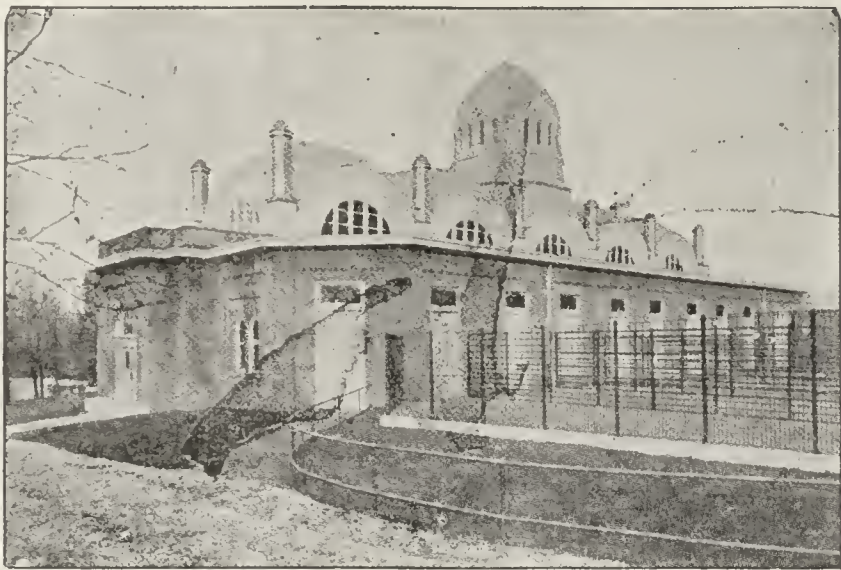
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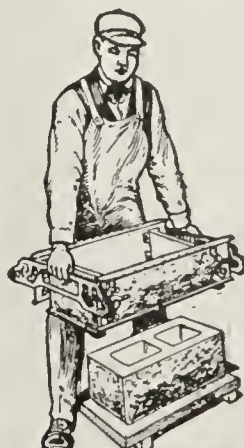
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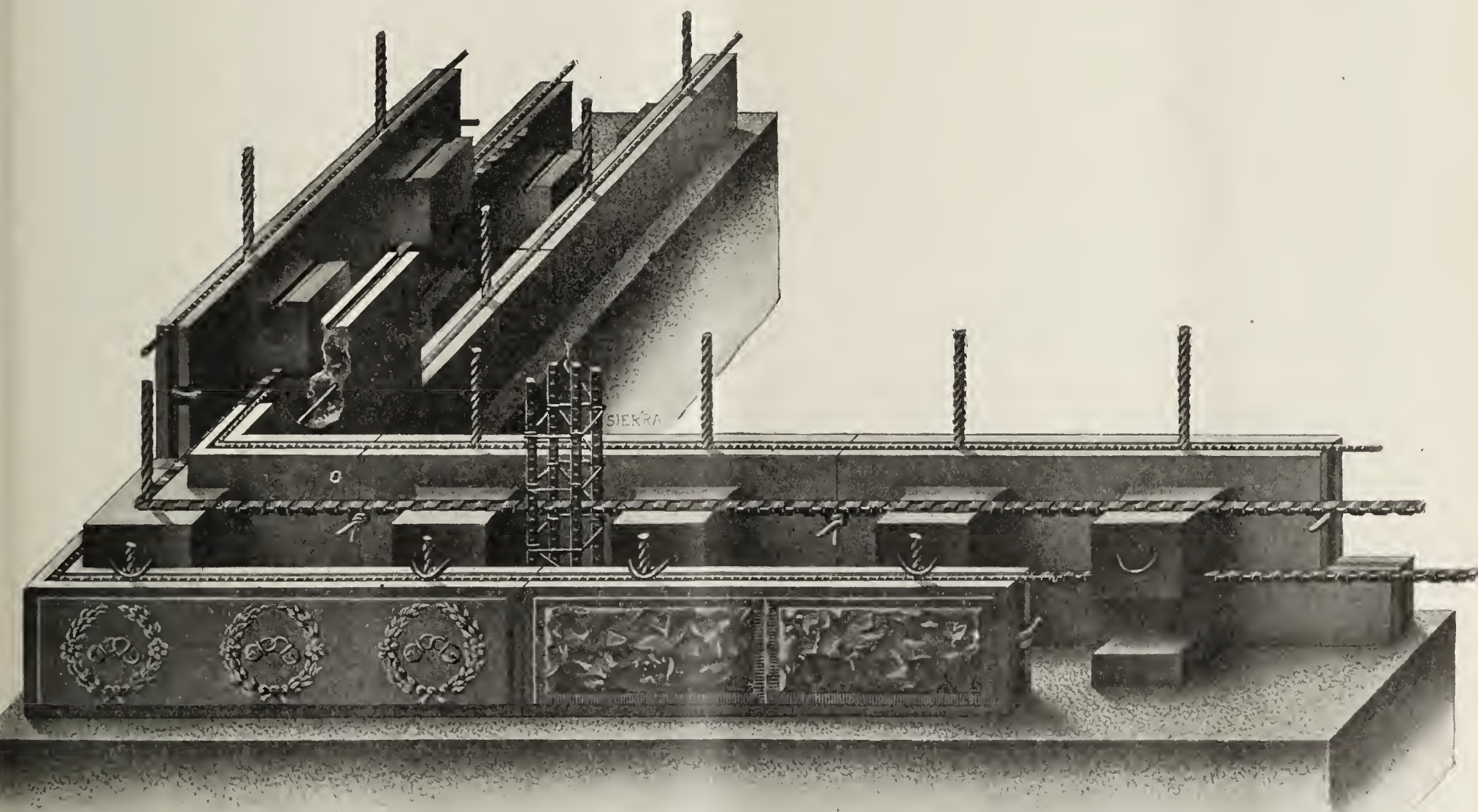
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ENGINEERING NEWS



An Interlocking Concrete Block.

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See page 149

CEMENT AND ENGINEERING NEWS

(PUBLISHED MONTHLY)

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CHICAGO, JUNE, 1908.

CORRESPONDENCE.

We solicit correspondence on all matters of general interest to the cement trade in all its branches. Engineering notes, public improvements, and facts and opinions drawn from practical experiments will be welcome.

CEMENT TRADE CONDITIONS.

The panic which has about spent its force in the East, is just now being felt in Chicago and the West. Conditions in the building material trade are frightful; prices are unsettled, dropping to the lowest point which has been reached in years, with a scramble for orders at any price. Building conditions are otherwise fair. The cubic contents or area of buildings under way is larger than in 1907, but the construction is on a cheaper scale throughout. The present prices of cement will seriously effect the Michigan Marl Mills. The Marquette Company, of La Salle, Ill., however, has been doing a flourishing business for the past few months, its orders and shipments being greater than at any previous time in its history. The rapid growth of cement manufacturing industry in the middle west is being felt by the eastern mills, and unless the railways make a substantial concession instead of an advance, the eastern cement will have to abandon the markets of the middle west very shortly. Even the mills in the middle west will be restricted to supplying local territory unless favored by a water transportation as an outlet.

PANAMA CANAL CEMENT BIDS.

On June 1st the general purchasing agent of the Isthmian Canal Commission opened the bids at Washington, D. C., for the purchase of 4,500,000 barrels of Portland cement to be used in the construction of the masonry work of

the Panama Canal, which were as follows:

Am. Trading Co., 25 Broad St., New York, N. Y., 1,400,000 bbl. English cement, delivered on dock at Colon, at \$1.70 per bbl., delivery to extend over 3 years; total cost, \$2,380,000, and also 500,000 bbl. to be delivered at dock in Colon, per bbl. \$1.70, delivery to extend over 3 years, for total of \$850,000—Alpha Portland Cement Co., Easton, Pa., 2,000,000 bbl., del. at dock in Colon, \$1.84½ per bbl. same quantity delivered Perth Amboy or Hoboken, \$1.44 per bbl.; 700,000 bbl. del. in Perth Amboy or Hoboken, per bbl. \$1.41; total, \$987,000; and 700,000 bbl. del. on Colon dock, per bbl. \$1.84, or a total of \$1,288,000—E. J. Duggan, 1133 Bway., New York, N. Y., 4,500,000 bbl. del. on Colon dock in bags, \$1.74 per bbl. with 7½ cts. rebate on each bag returned—East Asiatic Co., Copenhagen, Denmark, 500,000 bbl. del. on Colon dock, per bbl. \$1.70 (to be free of all taxes)—Edison Portland Cement Co., 1133 Bway., New York, N. Y., 1,500,000 bbl. del. on Hoboken, N. J., dock, per bbl. \$1.34; total, \$2,010,000, and in bags, del. at Hoboken, at \$1.44; total, \$2,160,000; 500,000 bbl. on dock in Hoboken, per bbl. \$1.24 total \$620,000, and 500,000 in bags, per bag \$1.34; total \$670,000, with 6½ cts. rebate for each bag returned—German American Portland Cement Wks., La Salle, Ill., 270,000 bbl. del. on dock at Colon, per bbl. \$2.11; total \$569,700—Lehigh Portland Cement Co., Allentown, Pa., 2,700,000 bbl. del. on dock in Jersey City or Perth Amboy, per bbl. \$1.44; total \$3,888,000, and del. on Colon dock, per bbl. \$1.84; total, \$4,068,000; also 900,000 bbl. del. on dock in Jersey City or Perth Amboy, per bbl. \$1.39½; total \$1,255,500, and same amount del. on Colon dock, per bbl. \$1.79½ total, \$1,615,500—Martin Earle & Co., Ltd., 139 Queen Victoria St., London, England, 1,000,000 bbl. del. on Colon dock, per bbl. 6 shillings 8 pence—J. Meurin, Andernach, Germany, 1,500,000 bbl. del. on Colon dock, in bags, \$1.96; total \$2,940,000, with 5 cts. rebate on each bag returned—Rheinisch Westfälisches Cement Co., Bremen, Germany, 1,000,000 bbl. del. at Colon dock, per bbl. \$2; total \$2,000,000—Süddeutsches Cement Export Co., Mannheim, Germany, 100,000 bbl. del. on Colon dock, per bbl. \$1.70—Sussex Portland Cement Co., New Haven, England, 216,000 bbl. del. on dock in Colon, per bbl. 8 shillings 8

pence; total 93,600 in pounds sterling—A. W. Themanson, Wathena, Kan., 120,000 bbl. del. in dock at New Orleans, La., per bbl., \$2.30, and in bags, \$2.40, with 14 cts. rebate on each bag returned—Western States Cement Co., Independence, Kan., 600,000 bbl. del. on dock at New Orleans, La., per bbl., \$2; total \$1,200,000—Wouldham Cement Co., 32 Bway., New York, N. Y., 1,800,000 bbl. del. on Colon dock at \$1.84½, or for one-half the quantity at \$1.76½; in bags, 41.625 cts., with 2 cts. rebate for each bag returned—Santa Cruz Portland Cement Co., Crocker Bldg., San Francisco, Cal., 4,500,000 bbl. in bags del. on Oakland dock, \$1.38¾; total \$6,243,750; 2,500,000 bbl. del. on Oakland dock in bags, \$1.38¾; total \$3,468,750, and 1,500,000 bbl. del. on Oakland dock, \$1.38¾; allowance for bags, 5 cts.—Atlas Portland Cement Co., 30 Broad St., New York, N. Y., 4,500,000 bbl. del. on dock at Jersey City or Hoboken, per bbl. \$1.19; total \$5,355,000; 4,500,000 bbl. in bags on N. J. docks, \$1.60; allowance for bags 8½ cts.; total \$7,200,000; or 4,500,000 bbl. del. at Northampton, Pa., Commission to furnish bags, 65 cts.; total \$2,925,000—W. R. Grace & Co., 1 Hanover Sq., New York, N. Y., 700,000 bbl. del. on Colon dock, per bbl. \$1.87; total \$1,309,000—Pacific Portland Cement Co., Pacific Bldg., San Francisco, Cal., 750,000 bbl. del. on dock at Penecia, Cal., per bbl., \$1.70; total \$1,275,000; in bags \$1.62, in bags furnished by Commission dock at Benecia, Cal., per bbl., \$1.70; total \$1,275,000; in bags \$1.62, in bags furnished by Commission \$1.14; total \$1,215,000; 850,000 bbls. La Boca delivery \$2.60 per bbl., in bags \$2.32, or in bags furnished by Comm. \$1.84; allowance for bags 6 cts., allowance for bbl. 30 cts.—Lehigh Portland Cement Co. and Alpha Portland Cement Co. of Allentown, Pa., 4,500,000 bbls. to be del. on dock in Jersey City or Hoboken, per bbl. \$1.42½; total \$6,412,500; del. on dock at Colon, per bbl. \$1.82½; total \$8,212,500; and 1,500,000 bbl. del. on dock in Jersey City or Hoboken, \$1.38; total \$2,070,000; same quantity del. at Colon \$1.78 per bbl.—Breitenburger Portland Cement Co., Hamburg, Germany, 150,000 bbl. del. on dock at Colon, per bbl. \$1.82; total \$273,000—Commonwealth Portland Cement Co., of Virginia, agency at Washington, D. C., 4,500,000 bbl. del. at mill, per bbl. 88 cts., and 4,500,000 bbl. del. at Colon dock, per bbl. \$1.28.

SAND-LIME MORTAR.

By Dr. W. Michaelis, Sr.

The following paper which was read in February, 1908, at a meeting of German engineers and architects, throws considerable light upon the hardening of sand-lime mortar and advocates the abandoning of the use of sand-lime mortar as practised up to this time. The object of the author is to induce engineers and architects to improve sand-lime mortar by admixture of cement or puzzuolanas in such a manner that the hardening of the binding mortar is positively assured in all cases:

Sand-lime mortar must undoubtedly be regarded as one of the earliest discoveries of primitive man. At the period when men abandoned nomadic life and built sacrificial altars to their deities, they certainly happened to use, beside other rock, limestone in the construction of their places of worship, altars and fireplaces. Such limestone can not have failed to have been calcined occasionally. When the fire was extinguished by water or rain and the calcined lime was hydrated, these men must have noticed the apparent energetic reaction accompanying the hydration of the calcined lime. If the resulting calcium hydrate in the form of lime paste or lime milk flowed into the ashes or upon sandy soil and if this mixture formed itself into a solid mass through the formation of calcium carbonate, this must have suggested to the observers the use to which the hydrated lime might be put, namely, the cementing together of stone materials. And as those who officiated at these ceremonies, supposedly the priests, were naturally the most intelligent, the application of the calcined and slaked lime must have followed shortly thereafter. Similar conditions must have brought about the application of gypsum. Although sand-lime mortar has been in use for thousands of years and has outlived itself, according to my conviction, and does not belong in the period of our present rapid advancement of steam and electricity, still obscurity prevails in its properties and its workings.

In number 85 of the "Deutsche Toepfer and Ziegler Zeitung" of October, 1907, an article was published on the "Hardening of Sand-Lime Mortar In Brick and Sand-Lime Brick Masonry" which contained the following paragraph: "Of late greater consideration has been given to the hardening of sand-lime mortar. Some observations in connection with certain peculiarities of sand-lime mortar when applied to some modern building materials have broached this subject. The cause of inferior results, for instance, was attributed to the properties of the mortar. However, all discussions pertaining to this subject have demonstrated, that the value of the composition of the sand-lime mortar as well as the hardening process remain unexplained." This declaration is perfectly true as far as pure sand-lime mortar is concerned.

The reason why the workings and the usefulness of this mortar, although in use for thousands of years, have not been cleared as yet is to be explained by the fact that, in the first place, no correct perceptions prevailed about the properties of lime-paste and that, in the second place, the carbonic acid absorbed by the

mortar has been taken as a direct measure for the progress of the hardening and the cementing process.

In order to thoroughly understand the nature of lime paste it is advisable to study its origin, that is to say the burning and slaking of the lime. In doing so I will start out from a calcspar crystal of 100 grams. This weight represents exactly the molecular weight of pure calcium carbonate, namely, one molecule of calcium oxide equal to 56 and one molecule of carbonic acid equal to 44. The specific gravity of calcspar is 2.72; the 100 grams, therefore, occupy 100 divided by 2.72 equal to 36.76 parts by volume. About the physical structure of the smallest particles imaginable, the molecules, nothing is known. As a matter of illustration, however, we may assume the molecules of a calcspar crystal to be composed of two rhombohedrons of equal size, one of calcium oxide and the other of carbonic acid.

When we calcine this crystal at 900 or 1,000 centigrade, the carbonic acid is completely driven off, for calcium carbonate dissociates under atmospheric pressure at a temperature as low as 800 centigrade.

In the calcining of limestone only a small percentage of shrinkage occurs; hence a very porous body must result from it; this becomes noticeable in handling a piece of calcined limestone, which appears to be lighter than the rock before burning, although the specific gravity of the calcined rock is far greater. Of the 100 grams of calcspar 56 grams of calcium oxide remain. The calcined lime has, according to the burning temperature, a specific gravity of from 3.1 to 3.4. At 1,600 centigrade it clinkers, at 3,000 centigrade it fuses. If we assume for the following calculations a medium specific gravity of 3.2, the 56 parts by weight occupy 56 divided by 3.2 equal to 17.5 parts by volume. Supposing that the pores shrink as much as the molecules of calcium carbonate, then the 36.76 parts by volume of calcium carbonate yield apparently 35 parts by volume of calcined lime; the shrinkage, therefore, amounts to 1.76 divided by 36.76 equal to 4.8 per cent, and the voids amount to 50 per cent.

The calcined lime may be slaked so as to form either dry calcium hydrate or lime paste according to the amount of water used for hydration. Upon slaking to dry calcium hydrate, for instance by immersion until the voids are filled with water, 56 parts by weight of calcium oxide combine with 18 parts by weight of water; the specific gravity of the dry calcium hydrate is 2.08. The 56 plus 18 divided by 2.08 parts by weight yield 35.58 parts by volume; hence the 17.5 parts by volume of calcium oxide plus 18 parts by volume of water resulted in about 35 parts by volume of calcium hydrate. Consequently no increase of volume takes place in the formation of dry calcium hydrate, LeChatelier declares to have observed even a small contraction.

Notwithstanding this declaration it is a well-known fact that a very noticeable increase of volume takes place upon dry slaking. The lime swells and finally occupies three times the volume of the calcined lime or six times its real volume. How is this to be explained? Upon slaking the molecules have been grouped in an entirely different way. While the molecules were formerly in arrayment, they are now dis-

arrayed like a cluster of burrs. If calcium hydrate crystallizes from its solution in water, thin hexagonal crystals are formed. But, if calcium oxide and water combine in the course of the slaking process, clusters of molecules are formed.

Calcium hydrate, therefore, behaves in a manner similar to water below the freezing point; this forms likewise molecule clusters and many points compel us to assume ice to be composed of clusters of twice three or of six molecules. Six molecules of water of the formula $H_2(OH)_2$ correspond exactly with $Ca_3(OH)_6$. We may, therefore, say dry calcium hydrate resembles hoar frost. When a powder of such a physical structure as dry calcium hydrate is to be stirred with water to form a paste, this will take a considerable amount of water, because in this case a large percentage of water is adsorbed. This surface attraction and condensation of the water necessitates a considerable rise of temperature; that this does not become noticeable if dry calcium hydrate is mixed with water is due to the fact, that the water immediately dissolves calcium hydrate, which process consumes as much heat as is generated by the process of adsorption. The lime paste thus obtained is entirely different from lime paste which is obtained by slaking calcined lime with three times more water than required for the chemical formation of calcium hydrate. The latter is more tender, it is greasy, smooth, gelatinous; after prolonged seasoning it becomes tallow-like. Dry calcium hydrate mixed with 70-75 per cent of water is liquid and water separates from it, if left to rest. On the other hand, lime paste obtained by slaking calcined lime with a large surplus of water to a stiff paste contains 60 parts of water to 40 parts of calcium hydrate, that is to say 150 per cent of water, and very stiff seasoned slaked lime still contains 100 per cent of water.

Thus the molecules of calcium hydrate in the form of lime paste are of a different structure from those of dry calcium hydrate. They are most likely more complex and contain more water. According to my conviction, lime paste is a hydrogel, that is to say, colloidal calcium hydrate with from 5 to 8 molecules of water for each molecule of calcium oxide, approximately $Ca(OH)_2$ plus from 36 to 48 H_2O of spherical structure. These formulas are only problematic, for in the case of colloids we cannot figure with exact molecular proportions.

He who has frequently to handle cement briquettes will have observed, under favorable conditions, that the briquettes sometimes adhere one to another by means of a slimy white gelatinous substance. This is, according to my analytical observations, calcium hydrate hydrogel of a high percentage of water with a trace of silica and alumina.

Common slaked lime represents a mixture of calcium mono-hydrate and calcium hydrogel and is by no means calcium-mono-hydrate plus water, as was the customary belief so far. The colloid nature of lime paste readily explains its physical properties, namely, its smoothness and plasticity, which permit of an admixture of substances which act as filler, and furthermore, its shrinking which makes such admixtures necessary.

This colloidal calcium hydrate or calcium hydrate

hydrogel is able to harden simply by loss of water in a manner which has never been thought of heretofore, namely, through the pressure of the masonry gradually piled up on it, which slowly presses out the colloid water which latter is absorbed by the brick. Dr. W. Michaelis, Jr., who made a thorough study of the various ways in which the hardening of colloids is brought about, demonstrated that slaked lime withstood a compression strength of 1,500 lbs. per square inch after all the colloid water had been pressed out with the exception of 16 per cent. However, the strength obtained through hardening by compression can not be expected to be very high in the case of the customary lean sand-lime mortar which is rather porous. The greater part of the pressure, therefore, is exerted upon the sand grains, while the colloidal calcium hydrate is only partly compressed. For instance, a mortar composed of one volume of slaked lime and three volumes of sand (the hydrated lime paste to consist of 40 parts by weight of calcium-mono-hydrate and 60 parts colloid water or of 25 parts by volume of lime to 75 parts by volume of water), would contain just enough lime to fill the voids of the sand. If in this mortar 50 parts by volume of the water were pressed out, only 50 parts of colloidal calcium hydrate would remain; yet these would fill only half of the voids. The pressure, therefore, drives the calcium hydrogel into the voids of the sand and makes further loss of water by compression impossible in the case of lean mortars. Only with rich mortars, for instance, one part of slaked lime to one part of sand, a considerable strength could be obtained alone by compression.

Ordinary sand-lime mortar, therefore, composed approximately of one volume of slaked lime to four volumes of quartz sand (which would be equal to 7 per cent of calcium oxide plus 93 per cent of sand, in the calcined state, or to 8 per cent of calcium-mono-hydrate plus 12 per cent colloid water plus 80 per cent sand) depends for its hardening mainly upon the formation of carbonate of lime. This process in turn is dependent upon the amount of moisture in the mortar. It is a well-known fact that the carbonic acid of the atmosphere can combine with the hydrated lime only in the presence of moisture. Dry carbonic acid and dry calcium hydrate do not react upon each other. Furthermore, we know from experience that a certain limited percentage of uncombined water in the mortar proves to be most favorable for the formation of carbonate of lime. Too wet a mortar can not combine with carbonic acid, because a thin film of carbonate of lime forms on its surface which prevents further access of the carbonic acid to the interior.

From this follows that it is of the greatest importance to keep the binding mortar slightly moist as long as possible.

This requirement was better fulfilled by the former slow method of constructing and by the more massive members of a building than by the present rapid construction and the narrow walls put up nowadays. Formerly, the mortar dried very gradually in the course of many months and even years. The colloidal calcium hydrate as a consequence could shrink very slowly and could combine with carbonic acid more

completely and in a more effective manner; the component parts of the mortar as well as of the masonry were thus cemented together in a more reliable way than today, when the masonry is dried out as quickly as possible and when this drying process is even accelerated by artificial means.

Through the action of carbonic acid upon the mortar the calcium hydrate is transformed into carbonate of lime; thereby the molecules which were formerly separated are hardened and cemented one to another and ultimately also combined with the sand grains to a solid mass. This process, however, goes on only as long as the mortar contains moisture, that is to say, uncombined water or, better expressed, colloid water. As soon as the mortar becomes dry, the transformation into calcium carbonate ceases and soft, amorphous calcium hydrate remains. Alone upon further absorption of water, which may occur through rain or other causes, the moist calcium hydrate can combine again with carbonic acid. But if the mortar is dried rapidly the calcium hydrogel dries in a short time; it shrinks to one-quarter of the original volume and leaves large pores within the lime paste surrounding the sand grains. After the mortar has become porous, the comparatively large voids formed by drying out can not be filled even if it should later absorb moisture and if the formation of carbonate of lime should continue; hence further formation of calcium carbonate does no longer assist in the cementing process. The calcium hydrate which is left can still be hardened through combining with carbonic acid, its adhesive power may even increase at places, where it is in close contact with sand grains; but the cohesion of the mortar as a whole can not be further increased, because calcium hydrogel is not a reversible colloid, that is to say, if once dried out, it can not be swelled again by water.

From this will be seen, that we have to distinguish between the hardening of the calcium hydrate and the cementing together of the aggregate; both are due to combination with carbonic acid and both are required in order to bring about a thorough cohesion of the mortar; yet the former, namely, the transformation of the calcium hydrate into carbonate, that is to say, its hardening, may be accomplished without achieving the latter, the hardening of the binding mortar as a whole. Hence the amount of carbonic acid absorbed by the mortar is by no means a criterion of its strength.

Attention is frequently called to the fact that formerly engineers used to be fully satisfied with a sand-lime mortar of from 7 per cent to 10 per cent of calcium hydrate, while such mortars are found to be unreliable today. The reason for this is that nowadays the mortar is not kept moist long enough, which alone would favorably influence the hardening of lime-mortar. This hardening, due to regeneration of carbonate of lime, has always been unreliable and the faster the mortar is allowed to dry the more unreliable it becomes. The former slow drying process, however, is untimely in our days of steam and electricity when rapid building is demanded.

Sand-lime Mortar Has Outlived Itself.

What I said about sand-lime mortar made of lime-paste refers almost as much to the mortar made with dry calcium hydrate; the only advantage of the latter is that it shrinks less and therefore cements the sand grains together in a more reliable way. The former discussion of the structure of the molecules of both kinds of calcium hydrate explains why the dry slaked lime of cluster-shaped molecules shows higher tensile strength, but lower compression strength than lime paste composed of spherical molecules.

At places where quartz sand did not exist and where mortar was made from lime paste and volcanic sands, pumice-stone or ashes, it was undoubtedly noticed very early that this mortar hardened very well, even better than that made with quartz-sand and that it was not softened and washed away by water. Thus at a very early period of building hydraulic mortars were discovered in volcanic territories, for instance, in the neighborhood of Mount Vesuvius at Puteoli (now called Pozzuoli, from which derives the word "puzzuolana") or on the Greek islands Thera and Aspronisi (now called Santorin and Nio). The Romans knew that this sand in the neighborhood of the volcanoes, this "pulvis puteolanus" was calcined by subterranean fires. From this they rightly drew the conclusion that also burnt clay must yield a puzzuolana. Therefore they made use of brick dust at all places where natural puzzuolanas could not be found. They thus obtained a very superior mortar, in fact so perfect a mortar, that we find it in many of the ancient buildings in a state of perfect preservation. Unfortunately, this practice of the Romans has been discontinued for many centuries.

Of late, there have been many debates about whether sand-lime mortar adheres better to clay brick than to sand-lime brick. From the foregoing discussion of the application made of brick dust for improving sand-lime mortar this disputed point can be easily cleared up. Without doubt, under the same conditions, the adhesion of sand-lime mortar to brick must be much better than that to sand-lime brick for the following reasons: In the first place, with sand-lime mortar used in connection with clay brick we invariably observe two ways of hardening, namely, the so-called hydraulic hardening and the hardening due to absorption of carbonic acid from the atmosphere. At the point of contact of the binding mortar and the brick, that is to say, on the surface of the brick or rather in its outer layers, as far as the lime paste is able to penetrate into the pores of the brick, a puzzuolana cement is formed. In addition to this, the bulk of the sand-lime mortar not in immediate contact with the brick hardens by formation of carbonate of lime. Every brick with the exception of clinker, that is to say, perfectly vitrified brick, represents a puzzuolana which yields in connection with slaked lime a hydraulic mortar, the strength and cementing value of which is far superior to the cohesion of the binding mortar. This explains the well-known fact that upon destroying of masonry the mortar disintegrates but can not be separated from the brick to which it firmly adheres. Such hardening and cementing by the formation of puzzuolana cement is out of the

question of course in the case of sand-lime brick. The regeneration of slaked lime to carbonate of lime, therefore, is the sole cause of the hardening of sand-lime brick masonry. Moreover, this latter process of hardening, which both brick and sand-lime brick have in common, can go on more perfectly in brick masonry than in the case of sand-lime brick, because the atmosphere passing through the porous wall does not give off its carbonic acid to the brick. On its way through the damp brick it becomes saturated with moisture and thus reaches the mortar and is able to combine with the calcium hydrate and to effect the hardening of the mortar in a more or less perfect degree according to the percentage of moisture in the mortar.

In the case of sand-lime brick, however, the atmosphere passing through the porous brick gives off its carbonic acid to the brick as long as the latter is moist. Not only does the lime, which has so far remained uncombined, combine with the carbonic acid of the atmosphere, but also the calcium-hydro-silicate, the cementing substance of sand-lime brick, is completely decomposed by the carbonic acid and transformed into carbonate of lime and silica-half-hydrate. Consequently only a very small amount of carbonic acid can enter the mortar through the small joint of binding mortar itself; but also in this case an obstacle is soon formed through a film of carbonate of lime on the outside of the mortar. Sand-lime brick which has been cured in the open air for many months will be more favorable in this respect, because the brick has had time to absorb carbonic acid from the atmosphere; but, as a rule, sand-lime brick is laid into the wall shortly after being manufactured.

From the foregoing follows that sand-lime brick should not be laid in sand-lime mortar, but in a hydraulic mortar so that the hardening does not depend exclusively upon the formation of carbonate of lime. Ultimately the calcium compounds of all cements are decomposed, if moist carbonic acid has access to them, and carbonate of lime is formed; yet this late formation of lime is a hardening process of secondary importance with the hydraulic cements.

In my opinion this explanation should end and clear all disputed points.

Should someone contend that the mortar in sand-lime brick masonry was frequently found hardened better than in clay-brick masonry this would by no means be a proof against my explanations. For, the mortar in sand-lime brick masonry, if kept moist, can harden better than the mortar in the case of clay-brick masonry which was dried rapidly.

Sand-lime mortar can properly harden only if it dries very gradually, which requires many months. This, however, does not agree with modern methods

of building, which require rapid and yet solid constructing. Consequently, sand-lime mortar must either be abandoned or it must be improved in such a manner that it meets modern requirements. The latter may be accomplished in a very simple way without interfering with the present methods of making sand-lime mortar. All that is required is to add hydraulic admixtures in the same manner as the Romans were accustomed to do.

The slaked lime ought to be mixed with less sand than customary, and, instead of the one or two parts by volume of sand which were omitted, brick dust, trass, infusorial earth or refuse of chemical works containing the proper kind of silica or a sand-cement mixture should be added. In this manner a self-hardening and uniformly hardening mortar is obtained which does no longer depend for its hardening upon combination with the carbonic acid of the atmosphere. This latter hardening process, which is and always will be unreliable, goes on very slowly, and in the course of time contributes to the strength obtained through the hydraulic hardening.

Another way of obtaining the same self-hardening mortar would be the application of dry-slaked lime, dry calcium hydrate, which is sold in bags, and which would have to be mixed with sand and one of the above mentioned hydraulic admixtures. Or hydraulic lime should be used instead of slaked lime.

The faster we build the more important it becomes to use quick-hardening admixtures to the sand-lime mortar; hence, in the first place, Portland cement or, better even, a finely pulverized mixture of two parts of quartz sand and one part of Portland cement. All puzzuolanas require a comparatively long time for the formation of puzzuolana cements, especially at temperatures below 12 centigrade; they, furthermore, have to be kept wet for a longer time than the quick-hardening Portland cement.

Slags and slag cements containing small amounts of calcium sulphides should not be used as hydraulic admixtures, at least not for dwellings on account of the long continued development of sulphuretted hydrogen by the action of the carbonic acid of the atmosphere.

In the foregoing I trust to have given a clear description of the workings of slaked lime and of sand-lime mortar according to our present day's knowledge, and hope to have demonstrated the insufficiency of sand-lime mortar. The improvement of the latter by hydraulic admixtures, which assure quick and reliable hardening would benefit manufacturer and consumer of slaked lime alike. Moreover, our rapid advance of the building industries makes such improvement absolutely imperative.

WHITE PORTLAND CEMENT.

The Sandusky Portland Cement Co., of Sandusky, Ohio, has placed upon the market a perfectly white Portland cement, adapted to high grade artificial stone work where a stainless cement is essential. It is much superior to the white French

cement, known as La Forge cement, which is not a true Portland.

The Medusa White Portland cement can likewise be used for exterior and relief work and other ornamental work, such as columns, caps, tile and mosaic floors, wainscoting, vases, seats and other garden and park furniture. This cement is

guaranteed to pass the specifications adopted by the American society for testing materials. The Sandusky Portland Cement Co., has issued a 16-page circular describing the stainless Medusa white cement, which can be had for the asking.

AN UNUSUALLY LARGE ROPE SHEAVE.

The accompanying cut shows rope sheave of unusual dimensions recently completed by H. W. Caldwell & Son Co., engineers, founders, and machinists, Chicago, Ill.

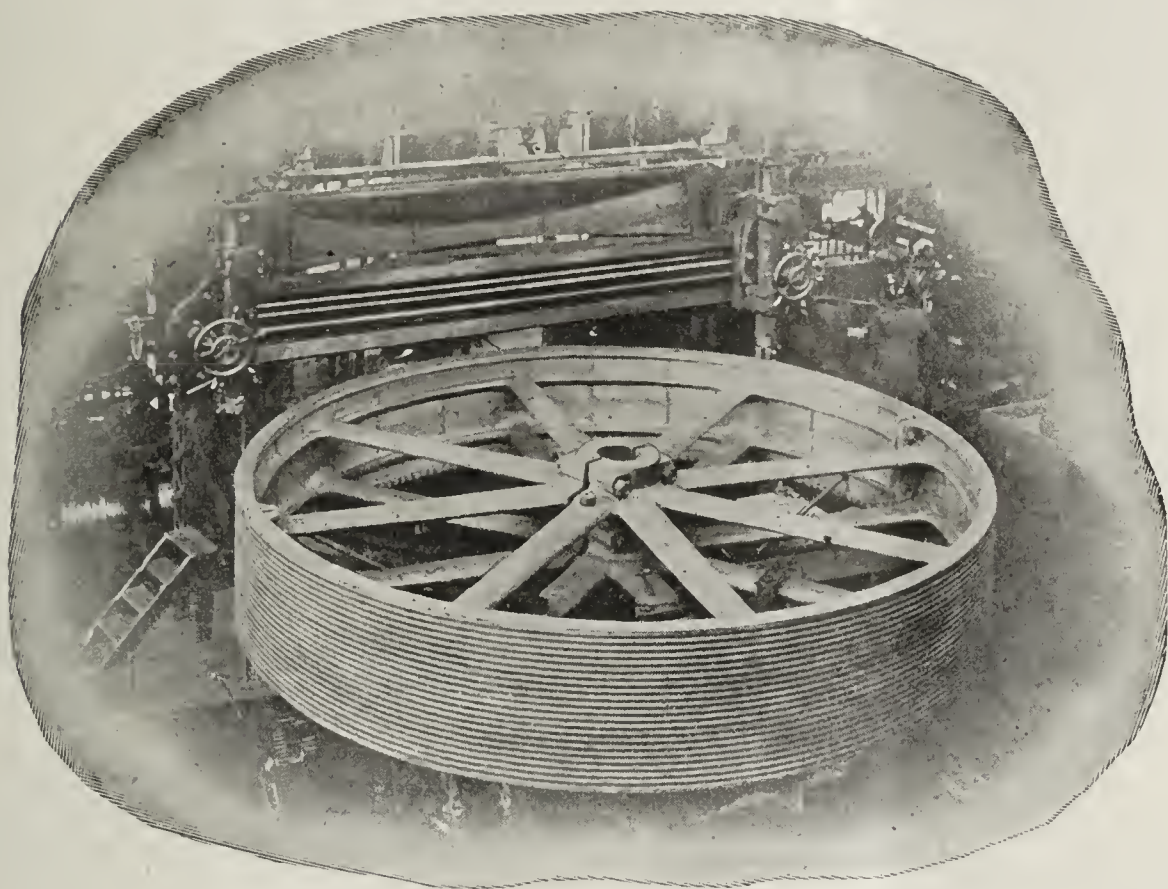
The sheave is 20 feet in diameter,

strong organization and sufficient pull to have five propositions calling for concrete curbing, changed to either blue stone or Medina stone by the local board at new lots. It is the old question of municipal economy against union extravagance. The concrete workers are

however, is in a measure due to the activity of the Medina company, which maintains an active and valuable agent in the Borough Hall.

MOTOR CARS IN GERMANY.

The reckless pace at which motor cars and motor bicycles are run in Germany, and the injuries resulting therefrom to the health, comfort and property of people using the highways, or living alongside of them has produced a somewhat unfriendly feeling towards these vehicles. To this feeling may be attributed in part the lessened demand for motors. The Farmers' Association of the Province of Nassau, in the Frankfort Consular district, at a recent meeting, adopted a resolution to request the Convention of the United Farmer's Association of Germany to move in favor of legislative action to restrict the fast running of these vehicles for the following reasons:—"Owing to the steadily growing motor traffic and the excessively fast pace at which these vehicles are run, serious accidents are of frequent occurrence, by which the life and property of the public is strongly endangered and actually injured. Furthermore, these risks are greatly increased by the motor races, which also incommode and hinder public traffic, particularly among the farming population of the districts where these races come off, by the shutting off for days of the roads over which the competing cars race. The executive officers of the farmers' associations are requested to urge upon the public authorities that in future motorists be held under stricter control, so as to avoid excessively fast running, especially when passing through



Rope Sheaver—H. W. Caldwell & Son Chicago.

has 20 grooves for 2" rope and weighs finished 48,000 pounds. It will be noticed from the illustration that the sheave has a double set of arms. The sheave was cast in one piece and then split for convenience in handling and erecting. The sheave was cast in the foundry of the Caldwell company and finished on 20-foot boring mills as indicated by the illustration.

It is intended for use in connection with the main drive in a refrigerating plant located in Mexico, the transmission being by means of what is generally known as the American or single rope system.

The City of Chicago has heretofore prohibited the use of limestone screenings in concrete work for street paving. An ordinance now permits the use of screenings when free from dust and other impurities. The local board of improvements is still opposed to lime stone screenings.

The union stone cutters of the Borough of Brooklyn, Greater New York, are opposing the use of concrete curbing which the borough authorities are endeavoring to substitute for stone in street improvements. The stone cutters have a

not organized to any great extent, while the granite and bluestone cutters have very effective organizations. The unions have been complaining for a couple of years past that concrete is rapidly displacing granite and blue stone, not ambitious and expensive building construction. The union representatives have apparently had their effect on the aldermen, who have this year evinced an astute interest in substituting stone for concrete in street repairing. This,

IMPORTS OF CEMENT INTO THE UNITED STATES.

WHERE FROM	APRIL				TEN MONTHS ENDING APRIL			
	1907		1908		1907		1908	
	Quantity in lbs.	Value in Dollars.	Quantity in lbs.	Value in Dollars.	Quantity in lbs.	Value in Dollars.	Quantity in lbs.	Value in Dollars.
United Kingdom . .	24,283,020	\$83,318	6,800	\$ 195	242,992,660	\$792,736	169,065,755	\$629,523
Belgium	45,275,372	137,677	9,749,420	30,597	298,884,883	928,389	142,164,152	452,210
France	625,700	2,273	922,600	3,184	13,775,318	52,436	11,105,927	42,603
Germany	42,223,707	136,420	3,210,280	10,721	392,453,111	1,230,331	207,948,099	687,565
All Other Europe . .	..	..	..	..	20,097,670	57,829	3,891,128	13,465
British North Am. .	2,700	23	800	4	3,106,983	22,686	276,540	1,628
Other Countries . .	250,418	1,152	1,000	25	51,959,155	259,606	5,706,947	30,080
TOTAL	112,660,917	360,863	13,890,900	44,726	1,026,269,780	3,344,013	540,158,548	1,857,074
Domestic Exports of Cement, bbls. . . .	55,935	89,013	66,836	101,963	550,967	908,768	777,415	1,214,077

There were 19,330,502 lbs. of imported Roman and Portland Cement, etc., in the United States bonded warehouses in April, 1907, valued at \$45,643, against 22,286,736 lbs. in April, 1908, valued at \$85,592.

For ten months ending in April, 1907, there were 83,658 tons of asphaltum imported in the United States, valued at \$354,004, against 107,479 tons imported in ten months ending April, 1908, valued at \$419,069.

towns and settlements, and that they be made to conform to municipal or police regulations, and that the violation of them be atoned by inflicting severer penalties than now in vogue." The running of races on highways used for public traffic is also sought to be prohibited. No doubt similar action will be taken by many other associations. The medical fraternity may join the protestants, because it is well known that the clouds of dust raised by the fast-running cars are great enemies to the lungs of the people and prolific generators of consumption and other diseases. The motor omnibus line between Wiesbaden and Schlangenbad, which started under great expectations has been discontinued because it did not pay.

THE CORRECT WAY TO APPLY DETACHABLE LINK-BELT.

By Staunton B. Peck, Vice-Pres.
Link-Belt Company.

Run Link-Belt with the back of the Coupling Hook to the Wheel, as in Fig. 1.

When considering the relative merits of the different methods of running chain-drives, the drive

eN; d, releasing point on the DriveN; as shown by a, b, c, d, in Fig. 1.

The action at a point is said to be **good** when all the articulation or bending takes place in the Joint of the chain, Fig. 2. The action is said to be **bad** when, in bending, the link rubs on the sprocket, producing wear on the sprocket and outside or external wear on the Hook, Fig. 3.

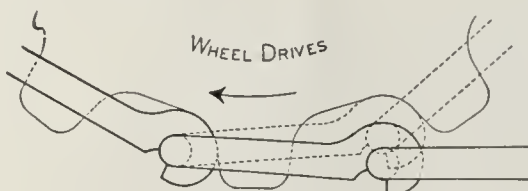


Fig. 2

Action **good**: dotted lines show position of the link after bending. All the wear is internal—that is, on the inside of the Hook.

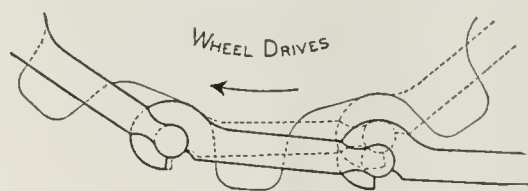


Fig. 3

Action **bad**: dotted lines show position of the link after bending. Wear on outside and inside of Hook and on the Sprocket.

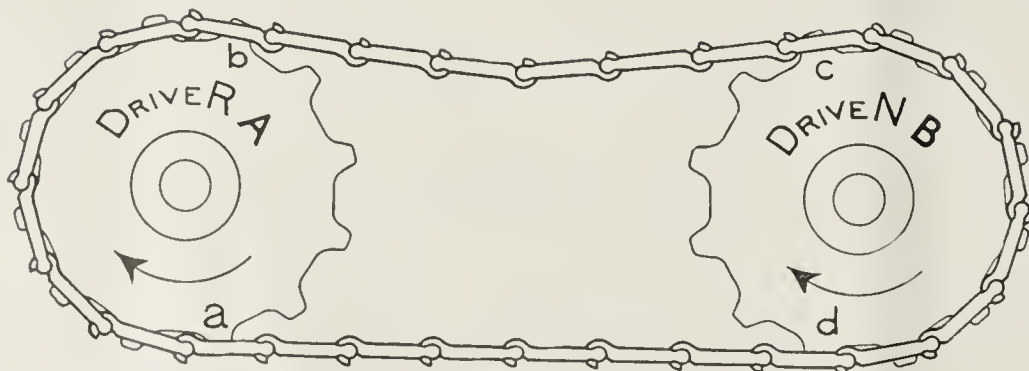
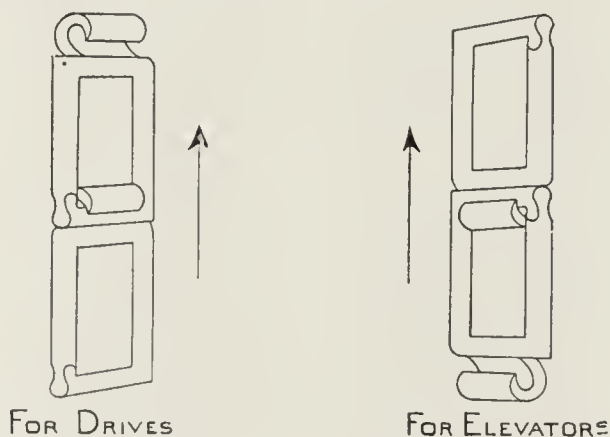


Fig. 1

a—entering point on Driver
b—releasing point on Driver

c—entering point on DriveN
d—releasing point on DriveN

should be considered as a whole, and the action noted at four points, viz.: a, entering point on the DriveR; b, releasing point on the DriveR; c, entering point on the DriveN;

Another fact is also to be remembered: there is never more than one tooth in action at any one time. No matter how carefully the chain and sprocket may be made, as soon as the load comes on, there is a change caused by stretch and wear.

We can pre-determine which tooth shall be in action by making

the pitch of the wheel either larger or smaller than the pitch of the chain. Thus, on the DriveR, Fig. 4, the wheel pitch being smaller than the chain pitch, the entering tooth does all the work. In Fig. 5 the conditions are reversed: the wheel pitch is the larger and the releasing tooth does the work. On the DriveN the same thing holds, except that here conditions are reversed.

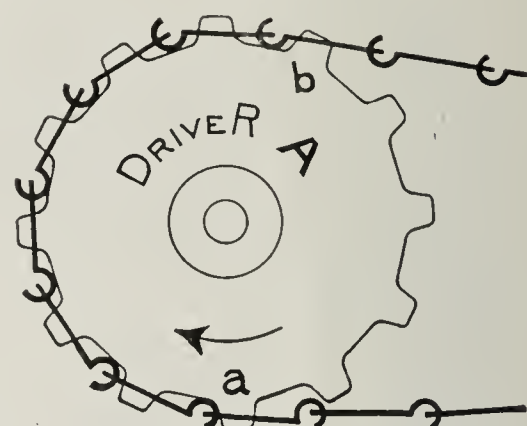


Fig. 4

Wheel pitch smaller than chain pitch. Entering tooth a does all the work.

When the wheel pitch is smaller than the chain pitch the releasing tooth does the work, Fig. 6. When the wheel pitch is larger than the

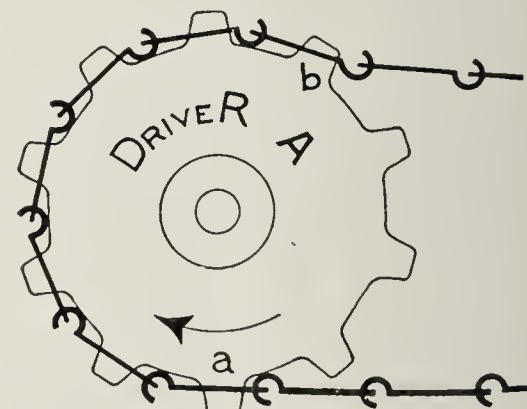


Fig. 5

Wheel pitch larger than chain pitch. Releasing tooth b does all the work.

chain pitch the entering tooth does all the work, Fig. 7.

For the best work the pitch of the DriveR should be larger than

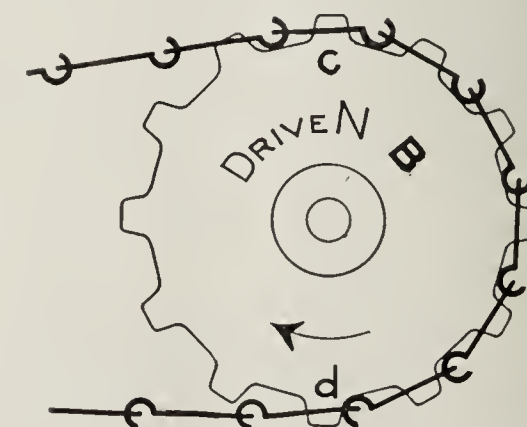


Fig. 6

Wheel pitch smaller than chain pitch. Releasing tooth d does all the work.

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LINK-BELT COMPANY

Philadelphia Chicago Indianapolis
1908.

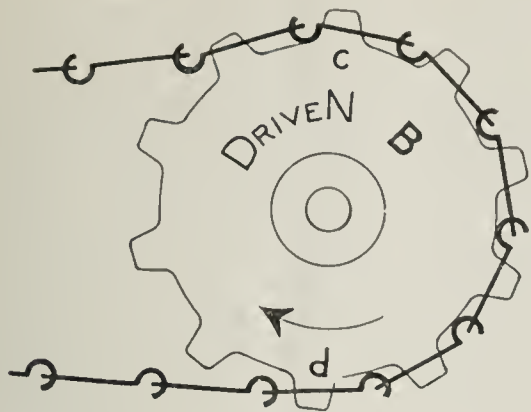


Fig. 7

wheel pitch larger than chain pitch. Entering tooth *c* does all the work.

the pitch of the chain, see Fig. 5. and the pitch of the DriveN should be **smaller** than that of the chain, as in Fig. 6. The releasing teeth, *b* and *d*, are, therefore, the working teeth and the chain can seat at *a* and *c* quietly and take the load gradually as the wheel revolves.

Having considered the question of wheels, now regard the drive as

Hook is not in contact with a tooth face at this point makes the consequent wear of little extent. The action at *b* is good. The action at *c* is bad, but this is on the slack side of the chain and this bad action

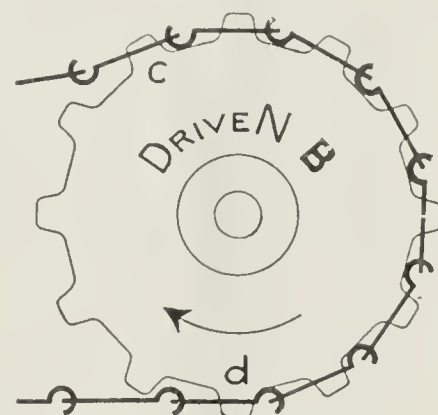
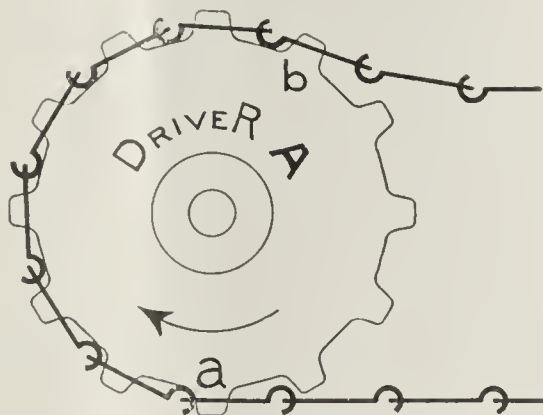


Fig. 10

Pitch of DriveR small, of DriveN small. Chain runs Bar first. Action at *a* good. Action at *b* bad, but not objectionable. Action at *c* good. Action at *d* bad.

causes no wear. The action at *d* is good.

It is thus seen that there are two

action is good; at *d* it is bad. In this case, therefore, it would seem that the wear would be confined to the DriveN wheel. This is so in actual practice.

Only wear is on DriveN, caused by the bad action at *d*. Forms hook on *d*, breaks chain.

Observe the same wheels with the chain running Hook first, Fig. 11. The action at *a* is bad; at *b* it is good; at *c* it is bad, but not objectionable, because, as before, there is no tension at this point; action at *d* is good. Thus all the wear would seem to be on the DriveR as a result of the action at *a*. This is found to be the case; hence both theory and practice show that with the chain running Bar first DriveN wheel wears, with chain running Hook first DriveR wheel wears.

Now, it is found that because the wear at *d*, running Bar first, is caused by the link slipping up the tooth it tends to undercut and form a hook and thus break the chain. On the other hand, the wear at *a*, when running Hook first, is caused by the link slipping down the tooth, and the wheel will wear out completely without endangering the chain. It has also been proved that the DriveR, running Hook first, lasts several times as long as the DriveN wheel when running Bar first. As the DriveN wheel is in nearly every case much larger than the DriveR and the consequent wear on each tooth is less, it would seem that if the chain were run so as to wear the DriveN, the wear on the two wheels would be equalized. This would be poor practice for the reason that the

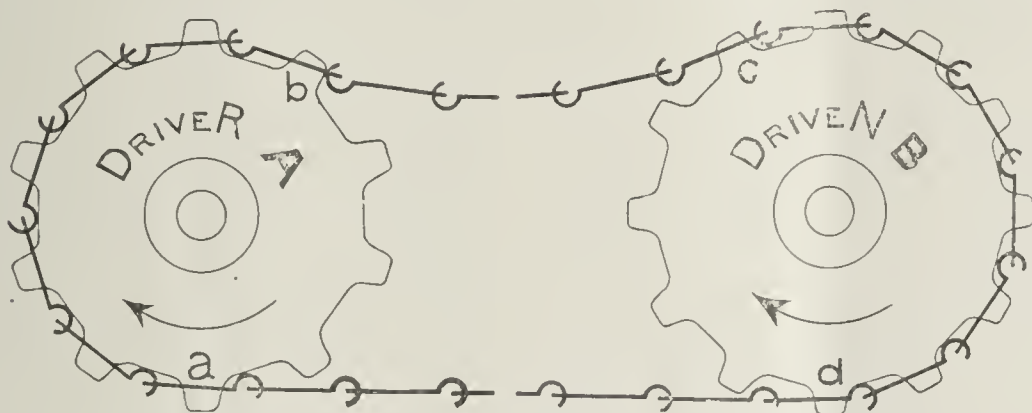


Fig. 8

Pitch of DriveR large, of DriveN small. Chain runs Bar first. Action at *a* good. Action at *b* bad. Action at *c* good. Action at *d* bad. Two (2) bad points.

a whole to determine whether the chain shall be run Bar first or Hook first.

In Fig. 8 we have the DriveR large, the DriveN small; hence *b* and *d* are the teeth in action. Chain runs Bar first: action at *a* good, at *b* bad; at *c* good, at *d* bad.

In Fig. 9 we have the same sprockets as in Fig. 8, but the chain runs Hook first. Here the action at *a* is bad, but the fact that the

very bad points (*b* and *d*) where the chain runs Bar first and only one serious trouble (*a*) when running Hook first. Therefore, run Hook first.

Consider a drive when the sprockets are such as are usually furnished: these are ground to fit the new chain; when the latter stretches, both DriveR and DriveN are small as compared to it, and teeth *a* and *d* are now in action.

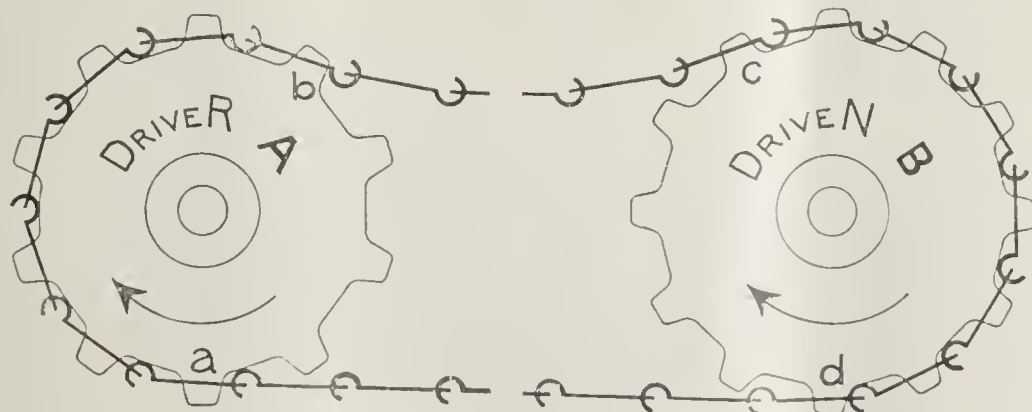


Fig. 9

Pitch of DriveR large, of DriveN small. Chain runs Hook first. Action at *a* bad. Action at *b* good. Action at *c* not objectionable. Action at *d* good. One (1) bad point—therefore, run Hook first.

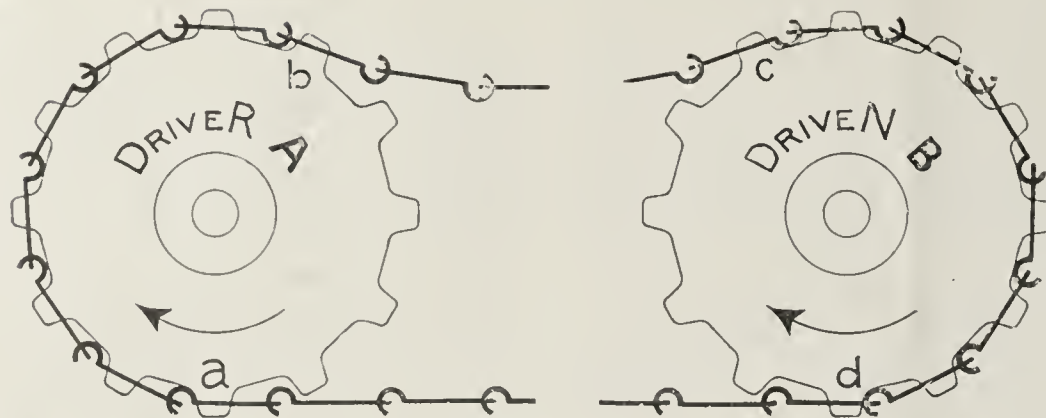


Fig. 11

Pitch of DriveR small, of DriveN small. Chain runs Hook first.

Action at a bad. Action at b good. Action at c not objectionable. Action at d good.

DriveR, being smaller, is more cheaply replaced, and the repair account will, therefore, be less running Hook first.

Only wear is on DriveR, caused by the bad action at a. Wears evenly, does not form hook at a, does not break chain. Run Hook first.

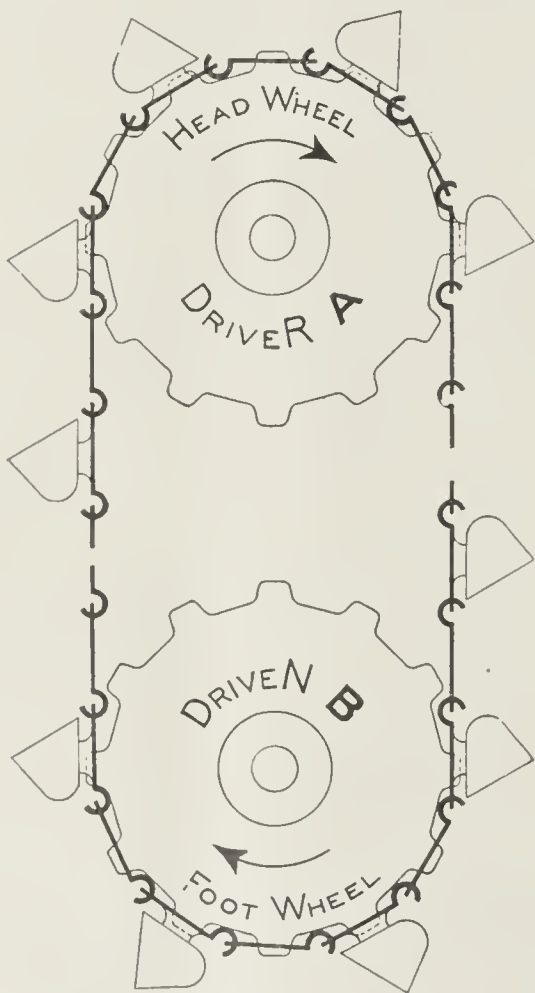


Fig. 12

In Elevators, Fig. 12, the head wheel acts as a DriveR, the foot wheel simply as an idler, because it is doing no work. Therefore, run the chain Bar first so as to favor the DriveR.

On Conveyors one wheel is always an idler, comparatively speaking, and the same reasoning holds as for Elevators: the chain should run Bar first in all cases.

The foregoing remarks apply equally well to all closed-end pin chains: the closed end corresponds to the hook and the pin end to the bar of the Ewart Chain.

In general, therefore, on Drives

run Hook first. O Elevators and Conveyors run Bar first.

The Newcastle Portland Cement Co., of Newcastle, Pa., will install twenty Griffin mill, single roll, at the finished end, and sixteen three roll Griffin mills, at the raw end, and four single roll Griffins on coal grinding. Mr. Phillips, of the Bradley Pulverizing Co., secured the contract for the above machinery.

The new Alamo Cement Company's plant, just north of San Antonio, Tex., has a capacity of 500 barrels per day.

Olympia, Wednesday, June 10.—Corporation papers have been filed in the office of the secretary of state as follows: Superior Portland Cement Co., of Seattle, \$400,000; by John C. Eden, G. W. Dickinson, W. D. Hoflus, E. E. Caine, Michael Earles, Fred T. Sherman, D. A. Robinson, James F. McElroy and A. R. Gardner.

The American Cement Company has declared a semi-annual dividend of 3 per cent, payable July 23. Books close July 11 and reopen July 24.

A semi-annual dividend of \$3 per share has been declared on the preferred capital stock of the El Paso Electric Company, payable July 13, to stockholders of record June 27.

Certificates of amendment were filed by the Pioneer Portland Cement and Development Company, increasing its capital stock from \$1,000,000 to \$2,000,000. These incorporators are of New York.

The Art Portland Cement Company at Kimmell is now in the hands of the Provident Trust

Company of Columbia City, Ind., as receivers. It is not known how much the liabilities of the concern will amount to, but the debt upon which the suit is brought is something like \$12,000, owed to Arbuckle Ryan Co., at Toledo. There are other liabilities that will have to be paid by the receiver. It looks as if the company would have to be reorganized, which will mean a big loss to the original stockholders.

The plant of the Peerless Portland Cement Company, of Union City, Mich., will close down Saturday night for an indefinite period, but with prospects of resuming operations in a month or two. Its large storage capacity is filled with the manufactured product, while sales have been slow.

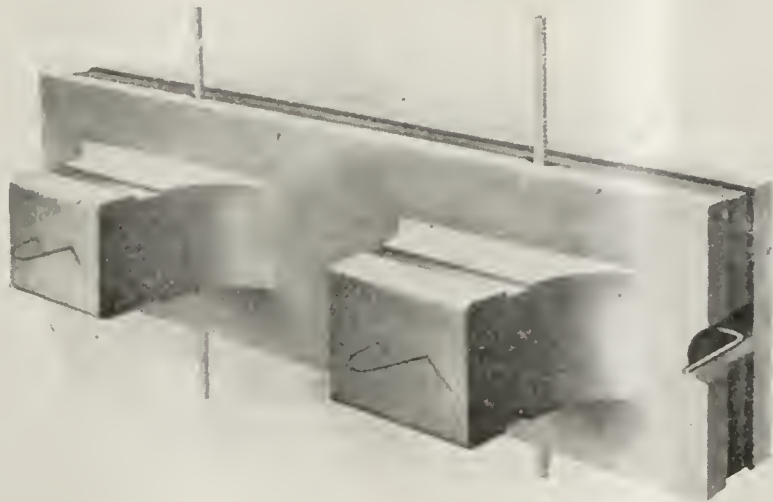
CONCRETE AS A BUILDING MATERIAL.

New England builders for some time have shown a keen, but rather timid interest in concrete as a building material, particularly for residential structures. Its use has grown enormously for heavy work, and it has made possible engineering triumphs on a large scale, such as bridge construction, which would have been out of the question with stone, owing to the enormous expense. But the day of the concrete residence is yet afar off in the eastern part of the United States, at least. Until architects with courage and men with money to spend, risk a few thousands in educational work, with the erection of more object lessons, the drain upon the timber supply will go on, and man will continue to house himself with the most perishable and expensive materials.

Concrete, or cement, lends itself so readily to all types of designs and presents so many advantages of economy that it is remarkable that experiments in cheap concrete house construction have not been more general. The hollow block, which is being made in increasing quantities, for some purposes, is as cheap as wood and it offers the sine qua non of comfortable walls, a dead air space between inside and outside; thus protecting against heat in summer and cold in winter. It requires no painting, and, as intimated, can be worked into an infinite variety of forms, giving an air of elegance to a house which, with any other material, would make the expense prohibitive. If there is, at present, any field at all for the development of residential real estate, it would appear to open in this direction.—Boston Transcript.

INTERLOCKING REINFORCED CONCRETE BLOCKS.

We illustrate an entirely new form of concrete building construction, being the invention of Geo. A. Peterson, of Oakland, California, superintendent of construction of the Interlocking Stone Company of the same place. The block consists of a face plate with two projecting lugs on the back, a wire reinforcement embedded in the center of the block. When two blocks are placed end to end the projecting wire ends are twisted together and locked together, while horizontal and vertical steel re-inforcing bars are embedded in the concrete, while skeleton steel columns are built up between the projecting lugs whenever required, forming a complete self-sustaining steel structure embedded in the concrete. This greatly simplifies the structural details, as there are either grooves or openings in the block to receive the steel bars so that the work can only be assembled upon true and correct lines. Where required, joist and girder stirrups and anchors are provided, always embedded in the concrete. A large four story building on this construction, built before the earthquake at Oakland, California, passed through the earthquake shock practically unharmed, requiring only a few slight repairs, while a new brick factory building within two blocks was completely destroyed, and a one-story brick flax mill on the opposite side of the street was leveled to the ground. The Interlocking Stone Company, 563 Ninth Street, Oakland, Cal., operating under the Peterson system, is attracting considerable attention of all progressive builders, architects and engineers in Oakland and that section of the country. The Interlocking blocks are produced by a new type of a mixing machine and hydraulic press capable of exerting a pressure of 1,000 tons, the machinery being at their own works for the trade.



Interlocking—Standard Reinforced Wall Stone.



Built of Interlocking Blocks Manufactured by Interlocking Stone Co., Oakland, California.

CONCRETE SHIPS.

Italy is considering the construction of seagoing steamships with hulls made of concrete.

The first occasion on which concrete was used as a shipbuilding material was in 1855, when a small boat made of it was exhibited at the Paris exhibition by a Frenchman named Lambot. This vessel, which is still afloat, was constructed of wire netting covered with cement.

It was not until 1896 that the matter was taken up again, and then an Italian named Gabellini constructed several concrete vessels of about 120 tons, some of which are still in use on the Italian rivers.

Some years later the Italian government gave instruction for an experimental boat to be built of concrete. This boat, of 120 tons, was built by Gabellini, and was subjected to severe tests in the dockyard at Spezia. A much larger iron vessel with a sharp ram was directed against it, but no impression was produced on or damage done to the concrete ship. The result was that

several similar vessels were built for the Italian government.

The general method of construction is as follows: The frame and longitudinal beams are made of concrete reinforced with round bars of iron, and the skin consists of a single or double layer of concrete stiffened with wire netting, and made perfectly smooth and watertight by an external coat of pure cement.

The boats cost almost nothing for maintenance, are fireproof, and cost about half as much as iron vessels of the same capacity.

An Italian engineer, Signor d'Ad-da, has also submitted proposals to the Italian government for the use of concrete armour on warships and a series of trials to test the resisting power of reinforced concrete is about to be made.—London Express.

The railways of the United States use more than a hundred million wooden cross ties each year. The average life of these ties is not over six to seven years, against twelve to twenty years for ties treated with wood preservatives. The American Railway Engineering and Maintenance Way Association has been appointed to investigate and report on the subject of wood preservation, with the view of adopting the best method for wooden railway ties. These figures show a great opening for a first class concrete railway tie.

PROTECTION FOR PILING AGAINST BORERS.

The extensive use that is made of piling in foundation work, especially where the substructure is wholly or partially submerged, calls for a careful study of the subject on the part of contractors in order that they may defend their work from deterioration through the ravages of borers. This pest infests practically all waters, and no submerged piling can be regarded as immune unless properly protected. Piles may be protected by the following methods, according to a Bulletin of the Forest Service:

1. External coatings. — These need be applied only to the portions

eliminates the dangers from insects and fungi.

(c) Flat-headed nails, resembling ordinary upholsterer's tacks (Fig. 2, b.) except that the heads are square, and larger. These are driven in close together, forming a continuous covering over the exposed surface. (Fig. 2, c.)

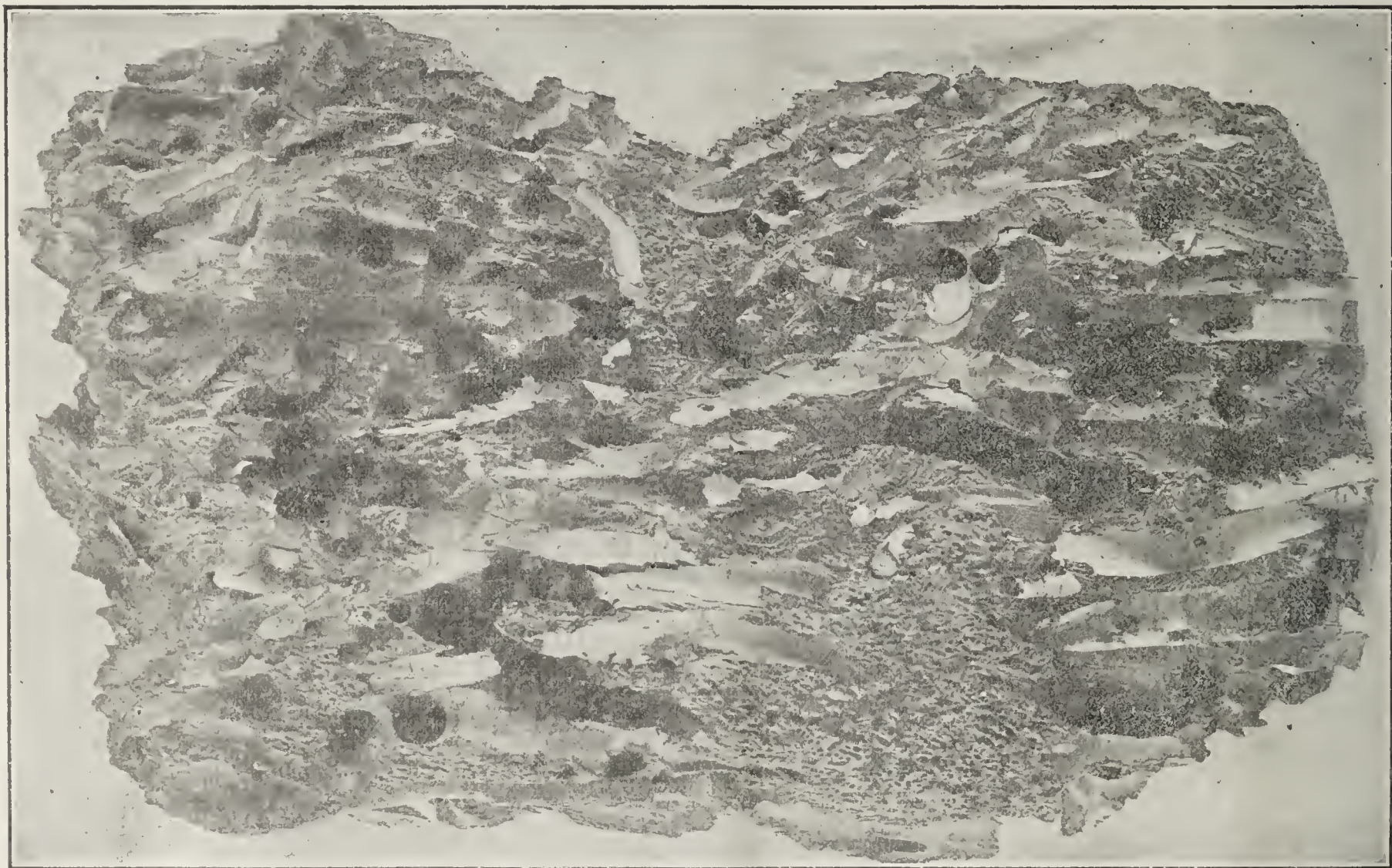
(d) Hot paints, tars, asphalt, etc. These are applied alone, or are further reinforced with fabrics, such as burlap soaked in the mixture or strips of coated batting. (Fig. 2, d.) Some of the combinations which have been used:

A mixture of asphalt, coal tar, oxide of copper, fish oil, oxaltic acid, and salt, in varying proportions, ap-

crushed granite added, and the whole wound with a fabric such as coarse burlap soaked in the above mixture.

A mixture of tar, asphalt, paraffin, cement, phosphorus, and hair applied hot to the barked pile; then a mixture of fire clay, sand, and cement added as a further protection.

(e) Metallic sheathings. Thin sheets of copper, yellow metal, or zinc are fastened over the entire exposed surface of the pile with copper nails, or sections of iron pipe are bolted together around it, and packed with cement or sand. These form a solid mechanical barrier against the entrance of borers. (Figs. 2, e and 3 f.)



Forest Service, U. S. Dept. of Agriculture, Washington, D. C.

of the pile exposed to attack, while the parts below the mud line and above high water, often 50 to 60 per cent of the entire pile, can be ignored.

(a) Bark left on the pile. This is an absolute protection against marine borers as long as it remains intact. (Fig. 2, a.) On the other hand, above the water line it offers an excellent place for insects and fungi, both of which may assist materially in the destruction of the pile.

(b) Thin plank, joined closely on the surface of the pile. This acts as an artificial bark, and partially

plied hot to the barked pile, and protected with strips of batting to prevent breaking the coating during handling.

A mixture of coal tar, pitch, and asphaltum, in varying proportions, applied hot to the barked pile; then a mixture of ground glass and flint sand added. This is protected by narrow strips of batting, coated with a mixture of all of these substances.

A mixture of slacked lime, asphaltum, hydraulic cement, brimstone, crude creosote, and asbestos in varying proportions, applied hot to the barked pile; then sharp sand or

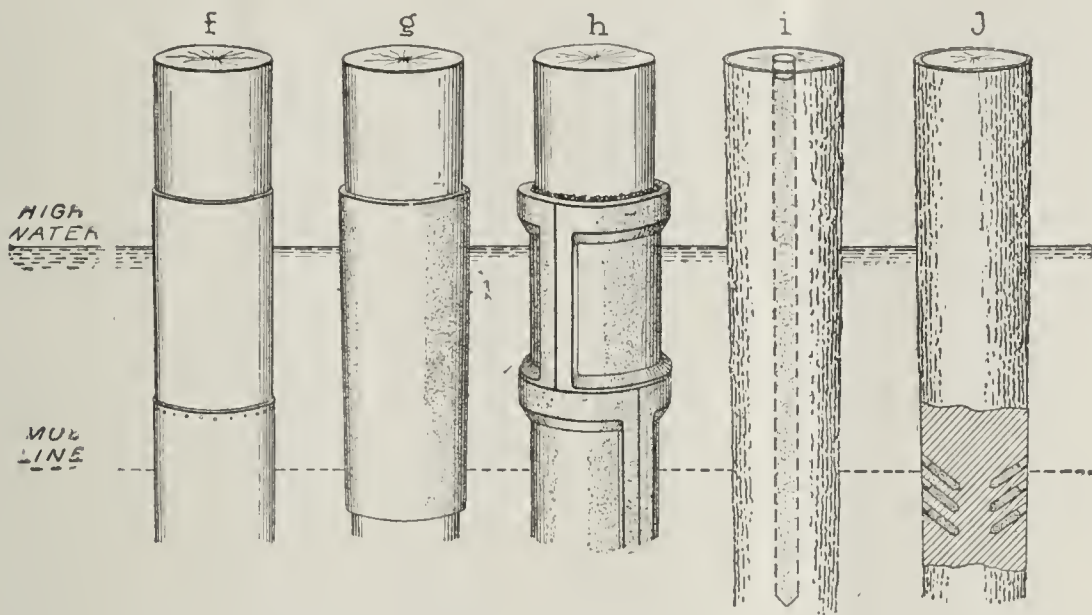
(f) Cement casings. These are made in two ways, (1) with no space between the casing and the pile, and (2) with an intervening space of from 2 to 4 inches.

The first are manufactured as follows: The bark and knots are removed and the pile driven. A jacket of iron, wood, or sewer pipe is placed around it, and the space between jacket and pile, which is from 2 to 4 inches wide, is filled with hydraulic cement. When this becomes hard the jacket is removed. Some jackets are so made that they can be applied to the pile without disturbing the superstructure, thus

making repairs to broken casings easy. (Fig. 3, g.)

The second class is composed of cement pipes divided longitudinally into two halves, which, when placed together around the pile, are joined by a scarf joint keyed with a wooden plug soaked in hot tar. These are made in iron molds nearby and are

the pile to a point which will be below the mud line when the pile is placed. This hole is filled with a poisonous substance, such as corrosive sublimate, and plugged. (Fig. 3, i.) Though hydraulic or steam pressure is sometimes used to distribute the poison through the wood, natural diffusion is generally relied

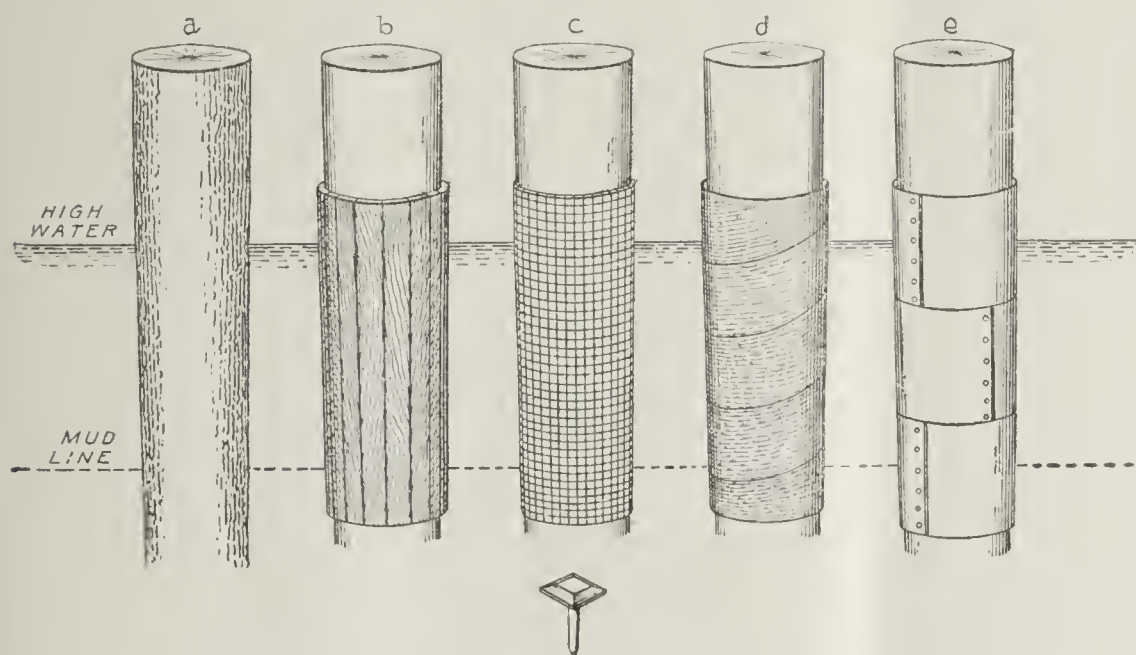


Forest Service, U. S. Dept. of Agriculture, Washington, D. C.

placed around the pile from a raft. The intervening space between pile and casing is filled with sand. (Fig. 3, h.) The chief advantage of this kind of casing is the fact that broken sections can easily be replaced without removing the superstructure, an operation which would otherwise make replacement very expensive.

upon. Holes are sometimes also bored diagonally near the ground line. (Fig. 3, j.) Capillarity is supposed to carry the poison upward through the pile. External coatings of other materials are sometimes used in addition.

(b) Injection of oils or soluble salts. This is done by means of pressure applied in a closed cylinder



Forest Service, U. S. Dept. of Agriculture, Washington, D. C.

(g) Earthenware pipes, joined by a special cement. These are lowered over the piles when driven, and the intervening space is filled with sand. The top section is either left open or capped with cement.

2. Preservative treatments.—(a) Injection through holes bored in the pile. A single hole is bored longitudinally into the top end of

under proper temperature conditions. By this method the entire pile is treated instead of the exposed portion alone, as in the case of the preceding method.

While the directions for defense against borers have special reference to marine work, they will be found equally as effective in fresh waters where these borers breed.

A 20TH CENTURY HOUSE.

The ideal twentieth century home has just been completed at Carrollton, Ill. The house is constructed of concrete and there is not a sign of a chimney, although the building is supplied with an abundance of artificial light and heat. Neither is there any fire in the house, nor coal, nor ashes, nor dangerous gases.

While this wonderful residence, built by Mr. F. H. Sinsabaugh of the Carrollton Light, Heat and Power Company is the first of its kind in the world, it is beyond a doubt a good example of what the average American home of the future will be when both wood and coal have become too expensive for common use.

Mr. Sinsabaugh's model home is two stories high and has eight rooms on the two main floors, with attic and basement. The foundation and walls are of concrete blocks. The concrete was mixed on the site and moulded into the building blocks as required, with no waste of building material. The floors are of wood and the interior is finished in plaster and oak. The style of architecture is of the mission type. The building has cost less than \$3,500. The interior is roomy and comfortable. The house is lighted by electricity.

Perhaps the most novel feature about this wonderful residence is the fact that it is heated by steam from a central station. There is no noisy, dusty furnace in the basement demanding daily attention all the long winter months. Instead the steam, which usually goes to waste about small electric light plants, is carried to the house by underground pipes. This steam pipe enters the house in the basement and is carried to the rooms in the usual way. A special arrangement had to be supplied to furnish hot water for the bath room. Near the ceiling in the bath room is located a water tank which is kept constantly hot by a number of small steam pipes through which a continual flow of hot steam is maintained. This tank supplies hot water for the bath and to the wash bowls located in two of the upstairs bed rooms. The house is also wired for electric heat in case anything should happen to the steam heating system.

When it is remembered that there are no fires about this modern dwelling the visitor begins to wonder how the meals are cooked. No steel or gas range is visible in the neat and roomy kitchen. The principal article of furniture seems to be an oak sideboard. This "sideboard" is nothing

more or less than one of the new General Electric Company's electric stoves. The back of the wooden cabinet is a small switchboard and all the utensils arranged on the stove are connected to this switchboard with suitable wires and plugs. A turn of a switch and the electric tea-kettle is singing over invisible heat. With the same case the frying pan, cereal cooker, griddle, broiler, vegetable cookers, etc., are ready to do their share of the work of preparing a meal. Beside the cabinet is the electric oven wherein the heat is so economized and concentrated that the choicest roast can be prepared in less time than it usually takes to start a slow coal fire. The other electrical kitchen devices, including the electric flatiron, are used in the same clean, simple and economical manner. There is no sweltering heat in the kitchen, no soot, no ashes, no dirt, no hot fires for ironing days; no lugging of heavy scuttles of coal from the basement.

In fact so easily are the meals cooked that the coffee, tea and toast are prepared right on the dining room table. The electric coffee percolater, prepares the coffee while the cereal is being eaten and the toast is ready when the coffee is. The cost of cooking the meals by electricity in this home is estimated at less than \$3.50 a month for a family of five persons.

By utilizing the waste steam from the electric light plant the cost of heating the house in cold weather is reduced to a minimum. Besides it saves caring for a dirty furnace and handling coal and ashes. The room that a furnace and coal bin ordinarily take up can be used for other purposes. With special meter rates for electric heating the cost of cooking the various meals is no more than as though coal or gas was used.

The greatest inventor and genius in the world has predicted that the house of the near future will be made entirely of concrete, cast in a mould. Scientists have predicted that the home of the future will have no chimney or flue. These ideas are all incorporated in Mr. Sinsabaugh's twentieth century home.

The Golden State Cement Co., will erect a Portland cement plant at Oro Grande, a station 31 miles south of Barstow on the line of A. T. & Santa Fe R'y. The Post office is known as Halleck, San Bernardino County, California, 110 miles north east of Los Angeles. The capacity of the plant is to be 1000 barrels per day. The work will be in charge of W. P. Echdahl as superintendent.

CEMENT PIPES FOR IRRIGATING DITCHES AND OTHER PURPOSES.

By G. E. P. Smith, Arizona Experiment Station.

Both seepage and evaporation from irrigating ditches are prevented by closed conduits. Cement pipe for small irrigating ditches is from every point of view to be recommended. It is composed largely of sand and gravel found in the vicinity of the ditches, and only the cement is subject to a freight charge.

With a view to determining the best mixtures and the cost of cement pipe in the Santa Cruz valley a molding outfit was secured and some experimental pipes were made. The size selected was of fifteen inches diameter and several lots of pipe were made of a mixture of one part cement to three and one-half parts unscreened arroyo sand. There were ten two-foot lengths, each hard and strong, of perfect shape and representing a cost of only 38 1-2 cents per lineal foot. The amount of cement used was five sacks.

The fourth lot was made of a very lean mixture of cement, lime paste and sand. The replacement of a part of the cement by lime was made for the double purpose of reducing the cost and obtaining a denser and more impermeable pipe. The paste was thinned to a consistency that permitted it to mix thoroughly with the sand, and the bell ends were made of a mixture of one part of cement to three parts of sand. The results were very satisfactory.

The fifth and sixth lots were made in another locality, and the sand and gravel were of a different character from those used previously, so that screening was necessary. all above one-half inch in size was rejected.

There is a difference of opinion in regard to the shape of the small tile and the kind of a mold to be used.

In California the bevel and tongue joint is used. It is quickly molded and quickly laid. The bell and spigot joint is liable to suffer injury to the bells, but will probably be laid with tighter joints than the beveled end pipe, especially by an inexperienced person.

For many years cement pipe has been an active competitor of clay tile in sewer construction despite the usually much lower cost of the latter.

Pipe culverts offer an ideal substitute for wooden bridges over ditches both in fields and in highways.

Still another use for cement pipe

is the draining of lowlands. For this purpose it is made straight without bell and is laid with open joints to admit the water. The Miracle concrete sewer pipe molds give good satisfaction.

REINFORCED CONCRETE IN SEA WATER.

The subject of corrosion of steel reinforcement was discussed by C. A. Harrison, D. Sc., in a paper presented before the International Railway Congress. An extract from the discussion by Mr. William Bell, is as follows:

The North-Eastern Railway first adopted reinforced concrete in 1903 for the foundations, pillars, floors, etc., of a block of offices in Newcastle, part of which is upon concrete piles. The company were about to erect a warehouse in Newcastle, and the drawings were all prepared for a structure in brick with steel stanchions and riveted girders, but, having looked into the question of cost, and the desirability of securing a fireproof building, I went into the question of reinforced concrete and the directors decided in its favor. This building, which I am told is the largest block of reinforced concrete actually in existence, is 430 feet long by 180 feet wide and four stories high. The ground floor is designed to carry a moving load of six good trains, and to withstand the strains due to the working of heavy traveling cranes and turntables, all worked by electricity. In the construction of the warehouse 2,600 tons of steel and 11,000 cubic yards of reinforced concrete were used, and it certainly proved less expensive than the ordinary method of brickwork and steel girders.

In regard to the corrosion of steel, Mr. J. S. E. de Vesian made the following statement:

With regard to the corrosion of steel in under-water structures, we have had now some ten or twelve years' experience. The year before last the question was raised by certain engineers in this country. Pieces of reinforced concrete piles, which had been cut off from piles driven in Southampton water some nine years ago and thrown on the foreshore, had lain on the foreshore for nine years, covered and uncovered by the tides, and three of these stumps were taken up and examined, and in no case was any sign of corrosion found in the steel. As a matter of fact, the bars that protruded from the end of the broken pile stumps were corroded entirely away, practically gone, but a quarter of an inch under the skin of concrete the bars were as good as when they left the mill. In fact, there

was practically no sign of rust of any sort. As Dr. Harrison says, there is a chemical action taking place when Portland cement surrounds iron which turns the oxide of iron into ferrite of calcium. If you put a rusty bar into the work, in a few months' time it will be comparatively clean if you cut it out. In fact, we prefer rather rusty steel going into the work. There have been cases of a certain amount of corrosion taking place if a piece of concrete is badly made and sea water can penetrate. Every reinforced concrete structure built in sea water should be examined six or eight months after completion and every faulty spot made good. If the work is examined then and made good the structure will be permanent. We have never had a single case of a reinforced concrete pile corroded, or being damaged by immersion in sea water. The piles are carefully made beforehand, and are matured before they are driven under the water. We have had 20,000 odd piles driven in this country without any damage to a pile by sea water, and that is a valuable record.

In regard to the repair of concrete piles used in dock work, the Chairman of the Congress remarked as follows:

I have myself constructed at Southampton a good deal of reinforced concrete work. There is one quay, 1,350 feet long and 50 feet wide, that has been carried to a very satisfactory conclusion. I think piles which have been driven in another situation for some eight years show no signs of unsoundness. We cannot tell what there is inside the pile, but as far as can be seen no corrosion of iron or swelling of the iron has affected the outside concrete. One good thing, as far as dock work and work under water are concerned, is that it has been found possible to repair piles by sinking a water-tight box and stripping the concrete where the piles have been damaged, as they have been in several instances. A danger in harbor work is that a vessel runs into the long piles and breaks the concrete into pieces, and when the concrete once goes the value of the work to a great extent goes with it, but it has been found possible to strip concrete and repair it under water. This is being done at Southampton and I think it has been done on some work Mr. Meik carried out on the Thames.

The village of Laurium, Houghton Co., Mich., is to lay 30,000 yards of cement sidewalks this season.

BOOK NOTES.

Concrete Construction. Methods and Cost, by Herbert P. Gillette, and Charles S. Hill. Myron C. Clark Publishing Co., New York and Chicago; 690 pages 6x9 in. Price \$5.00.

Every page of this book contains useful information for the practical man engaged in concrete construction. It covers every class of work in which concrete is employed in this country. It is up to date, showing the best methods employed in doing the various kinds of concrete work, from the simple sidewalk to the elaborate arched bridge work, with best data for every kind of concrete construction work, based upon work actually carried out. The methods of constructing and assembling forms for various kinds of construction work described and illustrated, is one of the good features in the work. The book should be in the hands of all persons engaged in concrete construction work.

CEMENT CONSTRUCTION IN MEXICO.

U. S. Consul General A. L. M. Gottschalk, of the City of Mexico, has made a report for the U. S. Department of Commerce and Harbors on the use of cement in Mexico from which we abstract and condense the following:

There is a great future for the use of cement in the larger cities of Mexico. Some 300 concrete houses have been built in the City of Mexico during the past few years. Concrete construction is beginning to find favor with architects and builders. Considerable bad work having been done by speculators who put upon the market badly made concrete blocks, causing cement work to be condemned. The earthquake of April, 1907, made a thorough test of several well constructed concrete block houses, which stood the shock better than surrounding buildings of other materials. This has given concrete block construction the preference.

The San Francisco office of the Power and Mining Machinery Company has been removed from 148-150 First St., to Room 217 Sheldon Bldg.

Dr. Samuel Walker Beyer, who has been elected Dean of the School of Mines and Metallurgy of The Pennsylvania State College in the place of Dr. M. Edward Wads-

worth, has been for many years head of the School of Mines of the Iowa State College at Ames, Iowa. He was educated at that institution (B. Sc. 1889) and at the Johns Hopkins University (Ph. D. 1895). He is a member of the Iowa Geological Survey, and Assistant Geologist on the U. S. Survey. He has published many contributions to the scientific journals, and also various reports on the mineral and mining industries of the Middle West. When he assumes his new office, the school of which he takes charge will be expanded into four departments, viz.—mining, metallurgy, geology, and ceramics, and the teaching staff will be enlarged by the addition of several new professors and instructors.

REINFORCED CONCRETE POLES.

The Windsor, Essex & Lake Shore Road of Windsor, Canada, has placed an order for 100 reinforced concrete poles with the Concrete Pole Co., of St. Catherine's, Ont., manufactured under the J. L. Weller patents, described and illustrated in our April, 1906, issue. 15 miles of poles on electric transmission lines in Canada. A 30 foot trolley pole required to carry 500 pounds of wire weighs about 13,000 pounds, while the length of pole to withstand a 1000 pound pull, weighs 2,000 pounds. A 150 ft. pole to withstand a 4,000 pound pull weighs nearly 45 tons. The concrete poles are much stronger than the wooden poles and will carry lines in a 60-mile gale where wooden poles fail.

CEMENT SHIPPED TO OUR INSULAR POSSESSIONS.

During nine months ending March 30, 1908, 128,660 barrels of American cement were shipped to our insular possessions, valued at \$223,509, distributed as follows: Alaska, 5,148 barrels, value \$15,064; Hawaii Islands, 19,824 barrels, value \$44,953; to Porto Rico, 103,604, value \$163,324; to the Philippine Islands, 84 barrels, value \$168. During the same period Alaska received 1546 barrels of foreign cement re-shipped from the States, valued at \$5234.

The Phoenix Cement and Manufacturing Co., of Cement, Stevens county, Washington, has been incorporated with a capital of \$1,000,000. Frederick G. Jordan and others incorporators.

France in 1906 exported 1,629,900 barrels of cement and imported during the same period 543,600 barrels, the excess of exports over imports being 1,086,300 barrels.

The joint bid of the Lehigh Portland Cement Company and the Alpha Portland Cement Company for 4,500,000 barrels of cement for the Panama Canal, was \$8,212,500, delivered at Colon, and \$6,412,500, delivered at U. S. ports.

FLOATING CONCRETE BATH HOUSES.

The city of Boston, which maintains a large number of wooden bath houses in the harbor, is under heavy expense each year to repair these bath houses, as they suffer destruction during the winter months. All the wood work that can be torn away is usually carried off; the lead pipe and fittings also disappear. The extensive repairs each year has caused Dr. Henry Erlich, chairman of the bath department, to make a close study of reinforced concrete, which material is to be used hereafter in constructing these floating baths, and thus save much of the cost of annual repairs.

The Iroquois Portland Cement Company of Caledonia, N. Y., which has been in the hands of a receiver for some time, and sold to Cleveland, O., parties, has now been acquired by the Marengo Portland Cement Co., of Detroit, by a deal with the holders of \$280,000 Iroquois bonds. The stockholders of the old company lose everything. The new company will reorganize with a capitalization of \$600,000. The plant is to be operated in the near future provided the cement market stiffens up to justify entering the market.

Judgment for \$60,000 was assessed against the Black Hills Portland Cement Company, of Rapid City, Dak., by Judge Kavanaugh, at Chicago, in favor of Philip W. Stanhope and Sampel Engs. The plaintiffs alleged that the company retained them to supervise the construction of and sell stock for a cement plant, and then suddenly terminated their contracts.

Captain D. W. Hand Constructive quartermaster U. S. army at Fort Barrancas, Florida, is advertising for bids for concrete walks, bids will be received up to 11 a. m. June

15, 1908; full information will be furnished on application.

Mr. F. M. Swift is promoting a company to construct a Portland cement plant near Marquane, Clackamas County, Oregon. Mr. Llewellyn Adams, a merchant at Oregon City, Oregon, has an interest in the project by being connected with a project to build an electric railway from Mt. Angel, Marion Co., to Marquane, the site of the proposed cement plant.

Lake Linden, Houghton Co., Mich., will have considerable cement sidewalk work done this season.

H. W. Caldwell & Son Co., of Chicago, Ill., engineers, founders, machinists and manufacturers of elevating, conveying and power-transmitting appliances announce that they have opened a New England engineering and sales office, room 337, Oliver Bldg., 141 Milk st., Boston, Mass.

This office is in charge of Mr. Malcolm R. White, mechanical engineer, who will give attention to engineering propositions, inquiries and orders from the New England States.

James S. Watson, Manager of the Drive Chain Department of the Link-Belt Company, has transferred his headquarters from the Philadelphia works to the company's chain manufacturing plant at Indianapolis. In his new field he will combine supervision of manufacture with direction of the selling force handling the Renold Silent and Roller Chains.

L. E. Becker, receiver of the Aetna Portland Cement Company, is to be discharged as soon as the proceeds of the sale of the plant is paid to the bondholders, who receive \$454.41 on each bond. The sum of \$45,604.35 remains undistributed. On June 4th the plant was sold for \$130,000.

The Hunt Engineering Company, of Iola, Kans., is to examine and report on the improvements required in the Iroquois Portland Cement Plant at Caledonia for the Marengo Cement Company, the new owners. There is some talk of increasing the capacity to 1,500 barrels per day. The output before

the plant was closed was 800 barrels per day.

A company is in the process of formation to manufacture cement at Interior, Stanley Co., South Dakota. The section has been known as bad lands, and heretofore been regarded as worthless.

The Empire Portland Cement Company, at Warners, N. Y., was to open June 15th. Mr. H. S. Hayden, general manager.

THE WHITE PORTLAND CEMENT CO. TO BE SOLD

The U. S. District Court for the Eastern District of Michigan, has entered a decree for the sale of all the property of the White Portland Cement Company, at 11 a. m., June 29, 1908, at the office of H. P. Davock, referee in bankruptcy, Room 405, No. 58 Lafayette avenue, Detroit, Mich.

The Fuller Engineering Company, of Allentown, Pa., have taken the contract for the designing and construction of the Seaboard Portland Cement Co.'s new 7,000 barrel plant, which is to be erected on their property near Alsen, N. Y. They already have between 200 and 300 men at work.

THE MICHIGAN CEMENT INDUSTRY.

Seventeen Portland cement plants in Michigan, in 1907 produced 3,644,473 barrels of Portland cement fifteen of these plants being in operation with a combined daily average output of 19,160 barrels, 57 per cent of the output was consumed in Michigan. The output was 105,056 barrels less than in 1906.

The number of men employed in 1907 in the industry was 1,862. The average daily was \$2.17 per man.

Flint—Receiver L. E. Becker reports that the indebtedness of the Aetna Portland Cement Co. of Eton has been reduced to \$892.71 during the past year.

Florence, Colo., April 14.—Owing to an unusual demand for cement the Portland cement company is largely increasing its force. During the money stringency the demand was so light that the night shift was suspended.

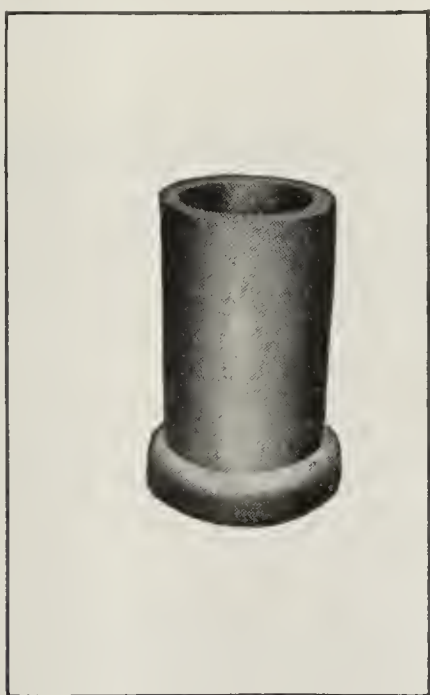
Columbus, Ohio.—Capitalists talk of erecting a plant for the manufacture of white portland cement, near that city, according to reports in the Columbus Ohio State Journal.

CEMENT BOOKS

How to Use Portland Cement	- - -	50 Cents
Cement Sidewalk Construction	- - -	50 Cents
Hollow Concrete Building Block Construction		50 Cents
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CLARINDA TILE & BRICK FACTORY

PAUL O. COOK, Proprietor

Clarinda, Iowa, Dec. 17, 1906.

Miracle Pressed Stone Co., Minneapolis.

Gents:—The tile molds I find to be just the thing. We had a good sale of the tile, it was late in the year to buy these tile molds but we had a good trade. We made about 3000 ft. of 12 in. tile; 2500 ft. of 15 in. tile; and about 1500 ft. of 25 in. tile. I think they are better than clay tile. They will stand frost better, and the older they get the better they are. A clay tile is no better than the day it is put in the ground—cement gets better the longer it is in the ground. I know this to be true; I have made clay tile for 16 years and am still making them.

Yours PAUL O. COOK.

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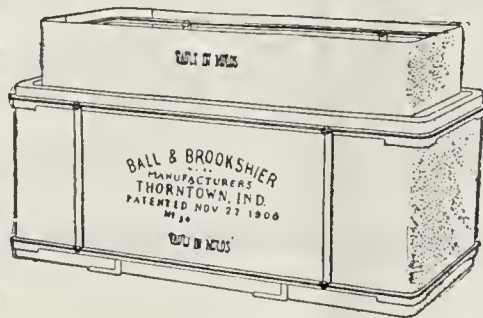
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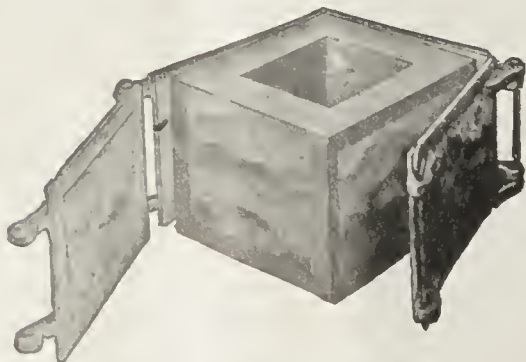
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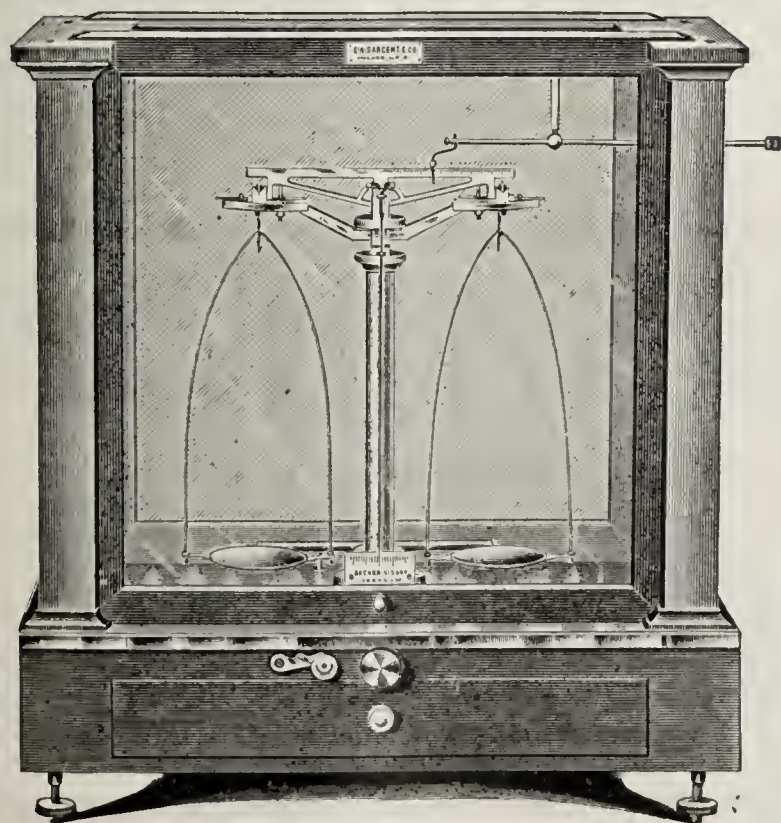
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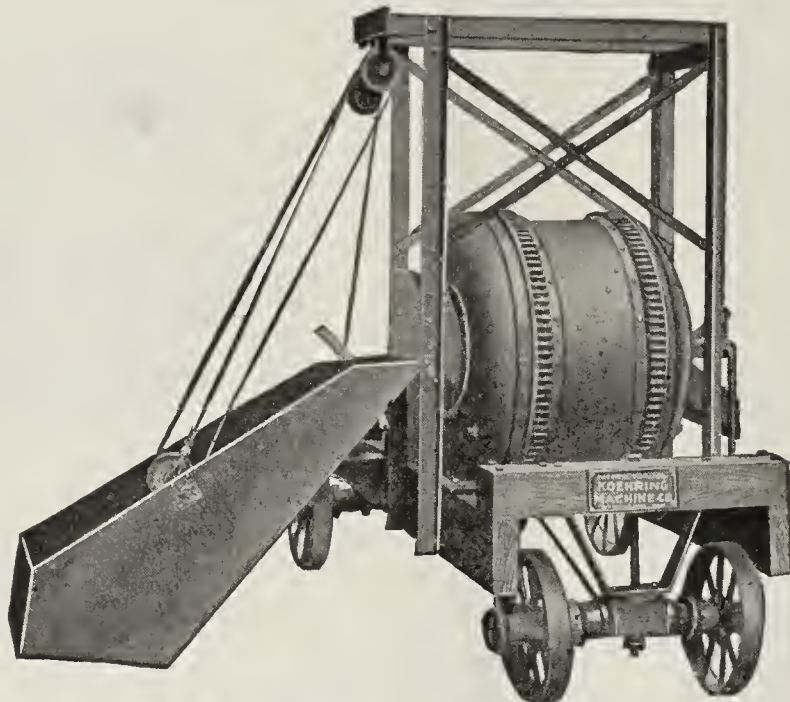
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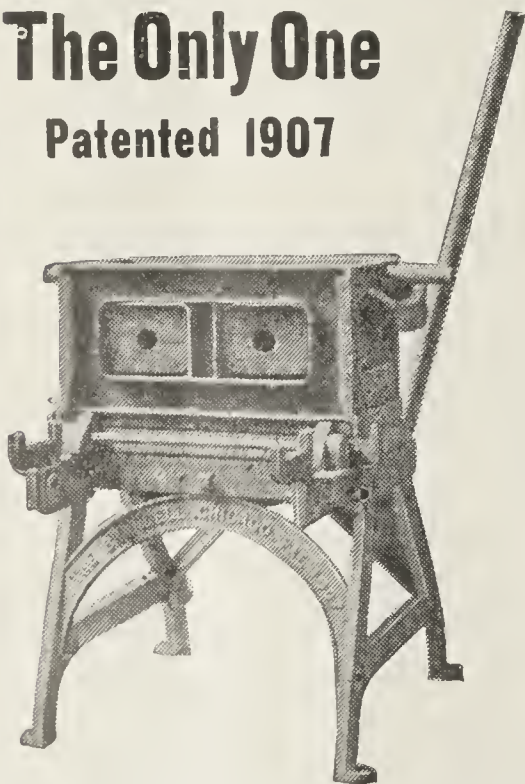
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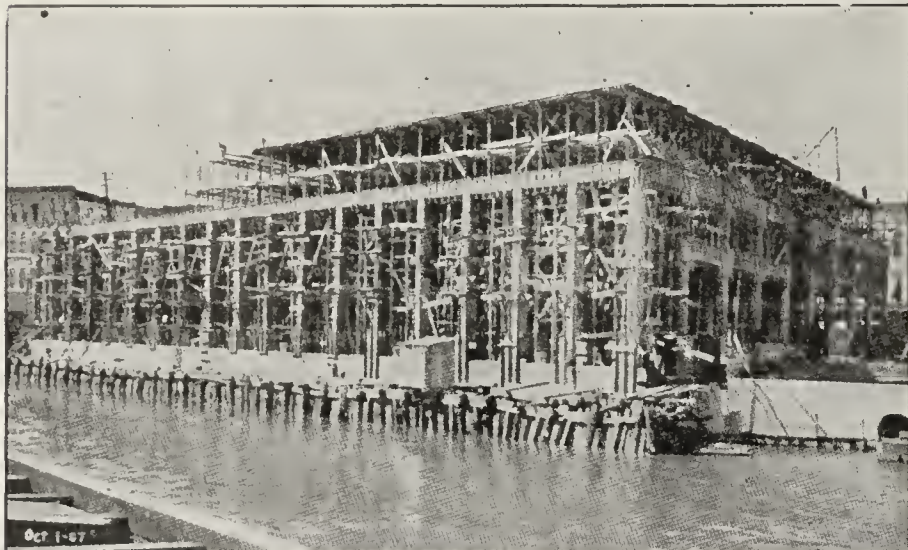
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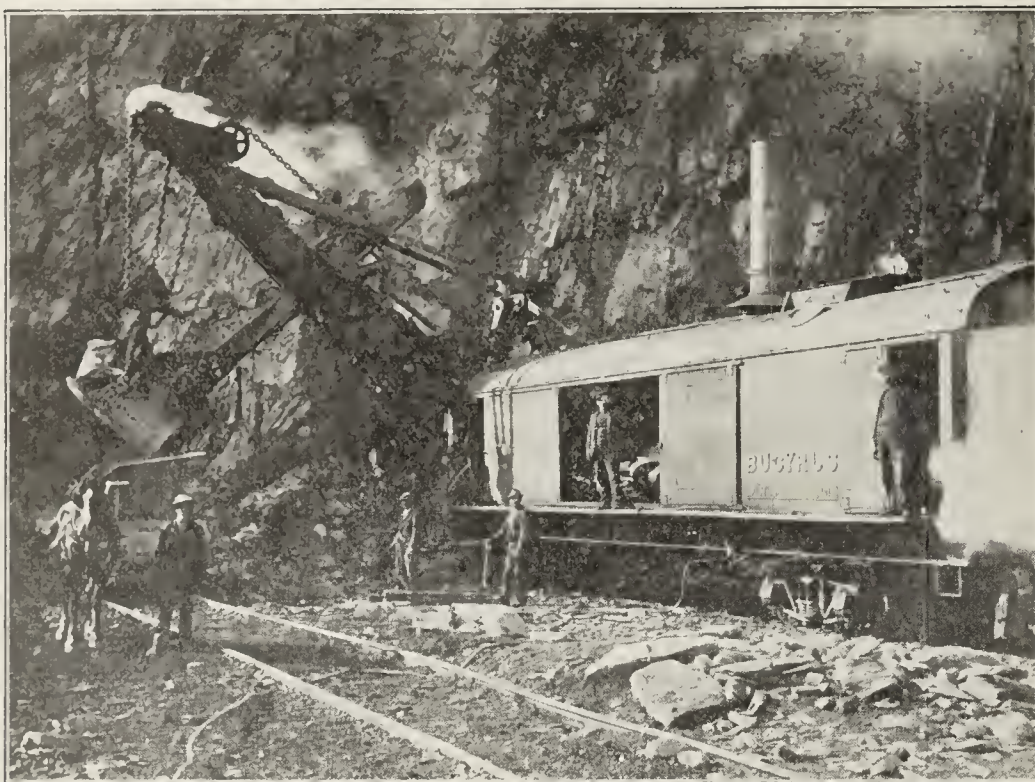
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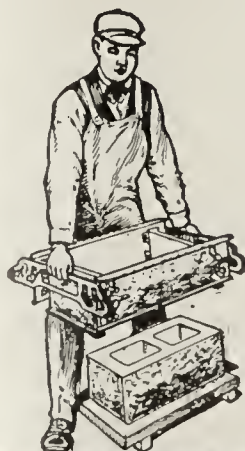
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Fig. 3. See page 178

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& Corrugated Bar Co., St. Louis, Mo.

CEMENT AND ENGINEERING NEWS

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CORRESPONDENCE.

We solicit correspondence on all matters of general interest to the cement trade in all its branches. Engineering notes, public improvements, and facts and opinions drawn from practical experiments will be welcome.

IRON-ORE CEMENT.

During the last six months the U. S. Government has made extensive investigations into the merits of iron-ore cement as compared with ordinary Portland cement with a view of using the iron-ore cement in the construction of the Panama Canal, especially at points where the cement is subjected to the action of sea-water. For this reason U. S. Consul-General A. W. Thackara was requested by the American Government to inquire into the subject minutely at the place of its origin and manufacture, namely in Germany. The result of this investigation we find published in the Monthly Consular & Trade Reports of June, 1908.

After a description of the method of manufacture and of the properties of iron-ore cement U. S. Consul-General Thackara discusses the experience which the German Government has had with iron-ore cement in connection with harbor work. From this we quote the following paragraph:

"The chief engineer of the vast harbor improvement works which are being carried on at Norden, Germany, writes me that since 1904 experiments have been made with iron-ore cement which was obtained from the Buerener Portland cement works in Westphalia. The iron-ore cement blocks were compared with those made from Portland cement purchased from the mills at Brackwede and Misburg. In 1905 the Portland cement blocks showed visible cracks, while in 1907 they commenced to decay. The blocks made from iron-ore cement, however, up to the present time have

lasted so well, that last year it was decided to use iron-ore cement in all repair and new works in the district. Since the commencement of 1907 the iron-ore cement has been obtained from the Hemmoor Portland cement works and has given great satisfaction."

This fact that the German Government is going to use iron-ore cement exclusively in place of Portland cement for all marine construction was the reason for the U. S. Government's decision in favor of the use of iron-ore cement in such construction work as the Panama Canal.

We feel that the value and permanency of harbor works will be greatly enhanced by the use of a cement of such excellent qualities and hope that city corporations as well as private individuals will follow the example of the German and the U. S. Governments and will give the iron-ore cement a thorough trial and, after being convinced of its exceptional merits, will use it permanently.

FILLING HOLLOW TREES WITH CONCRETE.

The Country Gentlemen, Albany, N. Y., describes the process of filling hollow trees with concrete in order to prolong the life of such trees, as follows:

The first thing to do is to clean out the cavity. All rotten wood should be completely chiseled out down to clean, sound tissue. Then it is customary to drive in some nails or spikes at suitable places for holding the concrete. The concrete is made up of sifted gravel and Portland cement, the usual proportion, 2 to 1, although a proportion of 4 to 1 is sometimes used. The cement is made up, poured in and tamped just as cement work is usually handled. When the cavity is full the outside is smoothed off. In some cases the outside is then covered with a tin or zinc sheet. There are a number of experts engaged in this business in different parts of the country, among whom may be mentioned H. L. Frost & Co., White Plains, N. Y., whom we can recommend highly. Where an expert can be employed for such work it is the most economical method, and certainly the safest for valuable trees.

We believe that the mixture of 1 to 4 is too rich. One to seven or even one to ten will be ample and will answer the purpose much better since the concrete will be more porous. This will enable moisture to rise in the concrete core by capillary attraction.

CEMENT TILE VS. CLAY TILE.

Two recent occurrences have precipitated a controversy respecting the relative merits of cement tile and clay tile. The first was a letter by Prof. Edward Orton, of Ohio State University, deploring the use of cement in tile drains. The second event was an address by G. G. Wheat, of Emmetsburg, Iowa, before the Iowa Brick & Tile Association, on January 23, 1908, and published in "Brick." Both letter and address have been reprinted and widely distributed by the clay tile manufacturers. The durability of cement is challenged, and an attempt made to destroy confidence in this material. That this attack will prove a boomerang there can be no doubt, since the positive evidence in favor of cement is overwhelming. It will prove of interest to every user of cement to have the points brought out by this controversy reviewed and analyzed.

Mr. Wheat's argument is entirely destructive. While citing several examples to support his theory regarding cement, he offers nothing in contrast to show the superiority of clay tile. Evidently assuming that all cement concrete is of one grade, he proceeds to take for his illustrations examples of poor workmanship, drawing the broad conclusion that all concrete will fail under similar conditions.

The anti-cement tile argument, as presented by Mr. Wheat, may be reduced to three propositions, as follows: First,—cement is soluble; Second,—Cement meets harder conditions of service when used in drain tile than anywhere else; Third,—where cement tile factories have been established, clay tiles has been practically driven out of the field. Incidentally, it may be noted, that Mr. Wheat is manager of a clay tile factory in northern Iowa, where the use of cement tile is increasing rapidly. As corollary to the first proposition, he states that complete solution of the cement matrix may take place in from six to ten years, and that perfectly set cement will undergo transformation and loss in solution. From the second proposition, it follows that the matrix will wash away and leave only a shell of sand, (although not a shred of evidence is given to bolster up this contention and that the use of cement tile so extensively threatens great harm eventually to drainage works). As to the third proposition, no corollary is stated, but this one is obvious; there must be a reason for the preference for cement tile.

Mr. Wheat endeavors to support

his argument by numerous illustrations which will stand analysis, but the mere statement is harmful because many people believe what they see in print. An instance of the wrong inference drawn by Mr. Wheat is the following: Thirty years ago a man living in Illinois built an ornamental fence of Portland cement concrete. Last year the fence was not to be found; therefore, it had rotted away. Therefore, cement is not a lasting material. No inquiry into the true cause for removing the fence appears to have been made.

Another peculiar illustration is this. A house in Des Moines is built of concrete blocks. The sidewalk in front of the house is dirty. Therefore, cement is unsuited for building blocks. However, the picture shown of this wall would indicate that it will be serviceable for several generations, assuming that the blocks were made with reasonable skill.

Singularly enough, Mr. Wheat offers no evidence of a single failure of cement drainage tile, although many miles of such tile have been the bases of his conclusions on observations of concrete curbs, fence posts laid in his neighborhood. Against one piece of curb in which the aggregate is exposed, the workmanship was poor, may be cited innumerable cases, in all parts of the country where the curb, being properly made, has stood for years and is to-day as good as ever. An Iowa druggist built a fence with concrete posts, but it lasted only five years, says Mr. Wheat. It is assumed that this druggist knew how to make cement posts as they should be made, used proper materials in correct proportions, and put in good workmanship. The feebleness of this illustration must have been felt by Mr. Wheat, for perhaps inadvertently he defends cement posts in these words:

"Concrete fence posts have been used in many places and to draw illustrations from them must not be construed as any argument against fence posts." Thus does he knock out the prop from under part of his argument.

Attention is drawn to the alleged failure of the concrete water table in the Palo Alto County court house at Emmetsburg. The claim is made that the projecting corners have disintegrated because subjected to an excessive flow of water. A photograph was shown with this comment: "The material was im-

perfectly mixed and the poorer part dissolved first. There is the answer—imperfect mixing. An investigation of this water table discloses some facts which Mr. Wheat failed to mention or to observe and are of interest. The building was erected in 1880. The corner stone, which is of limestone, is badly weather-worn, but the cement water table above it is in excellent condition. It is also noticeable that the limestone window caps are going to pieces, while the cement water table over them is absolutely sound. Unfortunately among the blocks in the water table are a few pieces showing poor workmanship, and so obviously is this the case that even Mr. Wheat has admitted the concrete was imperfectly mixed. Across the street from the courthouse is a hotel built the following year and which has concrete trimmings in perfect condition. These trimmings are remarkable as early examples of molding ornaments in concrete.

A cement cistern was found to contain hard water, and the wall was found to be somewhat porous. A coating of cement made the wall impervious to ground water and "the hardness of the water ceased." No suspicion was raised as to the stability of the cistern. Mr. Wheat attributes the hardness to infiltration of the ground water, and in this he is undoubtedly correct. It is difficult to see what bearing this illustration has towards confirming Mr. Wheat's theories. There is no evidence that the cistern referred to ever had been tight, and without such evidence no fair conclusion can be drawn. Furthermore, it is five years now since this cistern was repaired and, according to the rate at which cement goes into solution, as stated by Mr. Wheat, this cistern should be little more than a shell of sand. He would not have failed to make capital of it if the cistern had shown any sign of weakness at this time.

Again we learn that "there is and can be no such thing as a good cement drain. Even if it were all cement it would dissolve and carry away in one generation." We are expected to take this statement seriously. The claim that in six to ten years the cement bond is destroyed in such construction as cisterns and tile drains is based on a laboratory test of a fragment of concrete weighing 73 grams, which lost .0325 grams after soaking 72 hours in city water. As the concrete was a 1:3 mixture, Mr. Wheat argues that it would lose all of its cement in about six years. This

deduction is not warranted by any means. The test should have been repeated several times on the same sample for check results. It must be granted that a portion of the cement is soluble, but not all of it. The amount of the sample dissolved was decreasing rapidly with each trial, yet Mr. Wheat assumed that it would continue uniformly. The amount stated to have been successively dissolved per hour were .000452, .000335, .000411 and .000053 grams. The first and third tests were made with distilled water and show a falling off of 10%, the second and fourth made with city water show a decrease of 84%. The distilled water tests are not comparable with practical conditions, since ground waters always carry impurities in solution. The durability of cement is established by years of use on the spillways of dams and ancient aqueducts. When perfectly set, it is as lasting as stone. Mr. Wheat even admits that "Many instances of cement lasting for decades in sea wall construction can be found."

Thus we come to Mr. Wheat's third proposition which appears to be the nub of the whole matter, namely, that cement tile is killing the clay tile business. We have no reason to doubt this conclusion and Mr. Wheat is certainly in a position to know. Statistics bearing on the growth of the cement tile industry were furnished in a paper read before the Iowa State Drainage Association, February 12, 1908, by Mr. L. L. Bingham, who said, "We may say that the making of cement drain tile began as a business in 1903, and then only in hand made 12 in. to 24 in. sizes. Not until the end of 1906 were the more common 4 in. to 12 in. machine made cement tile put on the market and yet during the past year, the second season of their manufacture, the output was approximately 2,000 cars of 3,000 tile each * * * cement tile 40 in. in diameter and possibly a few of yet larger sizes were used in the past summer." What is called the Mud Creek Drainage Ditch in Kossuth Co., Ia., requires about 35 miles of cement tile ranging in size from 8 in. to 36 in. Many other large outlet drains are being built of cement tile. Dean A. Marston, Director of Engineering Experiment Station, at Ames, Ia., says, "I think that any competent engineer would admit the possibilities in every way." At the beginning of the year there were over fifty factories for making cement tile.

Reference has been made to a letter written by Prof. Orton, which

is being widely circulated. The substance of the letter is that cement drain tile "is exposed persistently to the very influence under which it most rapidly deteriorates," namely, "the solvent power of water more or less saturated with carbon dioxide" and organic acids which "tend to leach out lime" while "the constant filtration of air through its walls into the soil" "tends to oxidize the sulphides in the cement into soluble sulphates" and finally that the soundness and qualities of cement pipe cannot be told by the appearance. These are bare statements and as the context shows are purely theoretical. They assume a state of affairs which never exists. In the first place, drainage water in farming communities is very far indeed from being saturated with carbon dioxide, which is by the way the weakest of all acids. Typical analyses of drainage water from cultivated fields are given in U. S. Dept. of Agriculture, Bureau of Soils Bulletin No. 26, "Investigations in Soil Management," pages 23 and 77. The average from twelve wheat fields shows only 53.5 parts of carbonic acid and 32.7 parts of organic matter in 1,000,000 parts of drain water, and the worst sample taken from a drain under a block marsh soil gave only 340.6 parts of carbonic acid in 1,000,000 of water. The average amount of carbonic acid in ground water and open ditches is less than three parts in 1,000,000. The chemical activity of such exceedingly weak solutions is trifling and is not liable to attack the tile because of possible neutralization of the acid by lime in the soil. The analyses show three times as much lime as carbonic acid in solution, and carbonic acid would re-act with lime already in solution before it would attack solid lime in a tile.

The Professor should also have known that sulphides are either entirely absent from cement or present in such a minute quantity as to be negligible, and the percentage of sulphates is also so small that every particle could be leached out after the concrete has set without weakening it. That air should be constantly filtering through a tile in one direction, while water is constantly filtering through it in the opposite direction is almost too absurd to notice. Air cannot go through the tile unless there is a difference in pressure, but since the pressure inside the tile cannot be greater than that of the atmosphere, it would be necessary to assume a partial vacuum on the outside. Actually the pressure outside is greater

than atmospheric by the length of a column of water between the tile and the ground water level unless the ground water is below the tile when the pressure is the same on both sides. Finally it is difficult to see why the Professor should think it is more difficult to tell a sound tile of cement than of clay. It is entirely a matter of experience on the part of the inspector.

Among the advantages which cement tile has over clay tile are these:—

Permeability. This can be controlled by the manufacturer who can either make a porous tile or one that is water-tight. Porous tile give effective drainage throughout their length, while clay tile are impervious except at the joints.

Durability. Cement tile grow stronger with age, while clay tile attain their maximum strength when first made. On this point Mr. J. T. Sherer, of the Board of Public Works, Milwaukee, Wis., says: "In all places where we had to replace the sewers that were put in, in the early history of Milwaukee we found the concrete pipe to be intact. For instance, only recently we were required to take up 12 in. pipe and replace it with 20 in. and for the entire length that pipe was found to be in elegant condition—very much stronger than when first placed there. There was no defect or flaw from one end to the other."

Frost Resistance. Cement tile can be easily distributed along the line of the ditch in winter when haulage is easy over the frozen ground, and will withstand alternate freezing and thawing without injury even when partially immersed in water. Clay tile would be completely destroyed by such treatment.

Uniformity of Shape. Cement tile are always true to the mould, whereas clay tile warp out of shape in burning. It is therefore easier to lay cement tile.

Cost. Another advantage of no small importance is the fact that cement tile is cheaper in first cost and the clay tile interests simply cannot compete in price.

It is believed that the animus behind the attack on cement tile lies in the fact that tile drains of large size have been planned in Kossuth, Palo Alto, Hancock, and other counties in Iowa, under the direction of the Boards of Supervisors in each district. In the Kossuth lotting the clay tile people were beaten by the cement tile interests and shortly afterward at the Palo Alto lotting the clay tile people were underbid again. As it was im-

possible to lower the prices of clay tile so as to compete with any profit, the effort seems to be to frighten the Boards of Supervisors, County Engineers and land owners, so as to shut out the use of cement tile in this class of work. The attack is meeting only with ridicule in that locality.

In conclusion, it may be remarked that cement tile factories are springing up in all directions to meet local demands, and yet are running behind in their orders. There is a county ditch under construction near Emmetsburg, Ia., where nearly a mile of cement tile lay stretched out through a swamp for eighteen months, or through two winters before placing in the work. Some of these tile were entirely submerged, others partially and some were entirely out of water. They were subjected to freezing and thawing and yet were found to be in perfect condition this spring. It is well known that such treatment would have caused complete disintegration of a clay tile. The outlets of clay tile drains are always breaking down under frost action and the practice is to shovel out the fragments and leave an open ditch. Mr. Klemme, a banker of Belmond, Ia., knows a neighboring farmer who placed two laterals in the same field, one of clay tile, the other of cement. He raised a crop over the cement tile, but that over the clay was destroyed owing to failure of the drain to carry off the water before the young crop was killed. When sifted out then the attack on cement tile is found to have no foundation, in fact, it is a canard issued by the clay tile interests from selfish motives. The intelligent people of Iowa and other states are not being frightened because they know the truth from experience. The effect will be to strengthen the position of cement tile at the expense of clay.

A Fountain Mortar Trowel, built much like a low shoe is now used in laying brick. It is built of sheet metal, the mortar which is made rather slushey, is scooped up at the heel and poured onto the wall through a narrow opening at the toe, the opening being the full width of the Fountain Trowel. The trowel spreads the mortar over the full width of the wall for each course of brick.

Washington, July 1.—Major James P. Jervay, U. S. army, an expert in cement work, has been ordered to Panama on request of Col. Goethals.

THE NEW MILL OF THE UNION PORTLAND CEMENT CO.

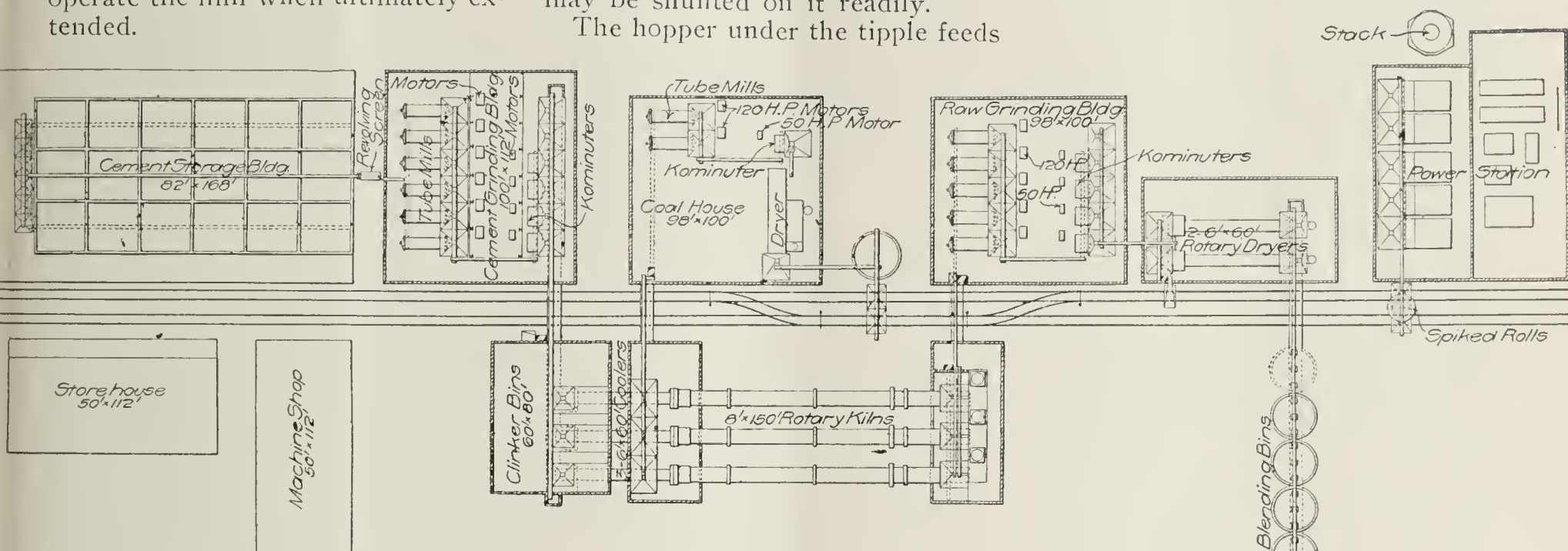
The Union Portland Cement Co., of Ogden, Utah, has recently placed in operation at Devil's Slide, in the northeastern part of that state, a cement mill with a rated capacity of 2,500 barrels a day. All parts of the mill are arranged, however, so this capacity may be doubled by the addition of more kilns and of some minor auxiliary buildings. The equipment of the entire mill is driven by individual electric motors, the alternating-current induction type being used in all cases, except for the kilns, which are driven by direct current motors. Power is supplied from a central station to operate the mill when ultimately extended.

ft. above the bottom of the canyon, and quarries opened on the up-hill side of these tracks. At present, the high-lime rock is loaded into 5-ton dump cars by a 70-ton Bucyrus steam shovel, and the low-lime rock is loaded into cars by hand. These cars are all handled in trains to a tippie and crusher house on the down-hill side of the bench cut containing the quarry tracks by a 25-ton Davenport locomotive.

The tippie and crusher house is 50x80 ft. in plan, and is on the steep hillside, with one end considerably taller than the other. The tippie is placed in the uphill end of this house, with the track on it at the level of the quarry tracks so the cars may be shunted on it readily.

The hopper under the tippie feeds

bins and a sampling house. This house and four of the bins have been built, with the intention of erecting the remainder of the bins as the mill is extended. The existing bins, which are each 24 ft. in diameter, and 30 ft. high, are built of steel and are on concrete footings. The conveyor belt which delivers to the bins is driven at a rated speed of 60 ft. per minute by an 85-h.p. motor. An automatic traveling tripper which enables the crushed rock to be discharged from the conveyor into any bin, is provided. On the carriage of the tripper is also mounted an automatic mechanical sampling device. This device enables a uniform sample of the rock



General Arrangement of Mill Buildings.

The mill is in very broken, mountainous country, and occupies the narrow canyon of a small mountain stream tributary to the Webber River, the site being just above the mouth of this small stream. The main line of the Union Pacific R. R. passes through the canyon of the river and a switch connection is extended from it to the mill. The canyon at the site is 250 to 400 yd. in width, the mill being close to the base of a long, high foothill from which the rock used in making cement is obtained. As shown in the accompanying illustrations, the principal buildings of the mill are placed far enough from the base of the hill to provide space for the contemplated extensions to be made toward the hill.

The long, high foothill contains almost unlimited quantities of high and low-lime rock, such as is required in making cement. The low-lime rock is at the upstream end of the hill, while the high-lime rock is toward the down-stream end, the two kinds being quite distinct. Tracks have been laid in a bench cut along the side of the hill, 60 to 75

a No. 9 Gates crusher, driven by an 85-h.p. motor, and two Williams rolls, each likewise driven by a 20-h.p. motor are provided below the No. 9 crusher. The output of the two No. 6 crushers is delivered to either or both of a pair of 400-ton proportioning bins; the rolls deliver to a bucket elevator which discharges into the bins. Provisions are thus made to handle both kinds of rock separately through the crusher house and to proportion them before they are sent to the mill.

The outlet from the proportioning bins is at the base of the down-hill side of the crusher house, where the rock is discharged on a 24-in. Caldwell conveyor belt leading to a row of blending bins. This conveyor rises on an inclined trestle for 70 ft. to a height of 33 ft. above the ground, and then extends 200 ft. horizontally at that height on a trestle over the bins. All of this trestle work is of steel and the conveyor is enclosed in a galvanized sheet-iron housing carried by a light steel frame.

Space is provided under the trestle for seven 1,000-ton blending

bins and a sampling house. This house and four of the bins have been built, with the intention of erecting the remainder of the bins as the mill is extended. The existing bins, which are each 24 ft. in diameter, and 30 ft. high, are built of steel and are on concrete footings. The conveyor belt which delivers to the bins is driven at a rated speed of 60 ft. per minute by an 85-h.p. motor. An automatic traveling tripper which enables the crushed rock to be discharged from the conveyor into any bin, is provided. On the carriage of the tripper is also mounted an automatic mechanical sampling device. This device enables a uniform sample of the rock

to be obtained and delivers beyond the tripper to the same conveyor, which carries the sample to the house at the end of the row of bins. A small crusher and disintegrator are installed in this house to reduce the sample to proper size for testing. A concrete-lined tunnel, 10x10 ft. in cross section, extends longitudinally under the row of bins, and is continued beyond the end of this row, under two railroad switch tracks and under one end of a 54x100 ft. dryer house to the foot of an open elevator in the latter. This tunnel contains a gravity overlapping Link-Belt bucket conveyor, which has 18x24 in. buckets,

and is driven by a 30-h.p. motor. Crushed stone is delivered to this conveyor through gates in the bottom of the blending bins. Five of these gates, which are of a special automatic feeding type, driven by the conveyor and designed to deliver fixed quantities of material to the latter in a given time, are provided in the bottom of each bin.

The 54x100-ft. dryer house to which the bucket conveyor delivers is of the same construction and general type as the remainder of the buildings of the mill. It has a structural-steel frame, with sides and roof of galvanized corrugated sheet iron. The eaves of the buildings are high, and the roof is built at a pitch of about 60 deg., with the idea of presenting a sufficiently steep surface to avoid the accumulation of dust. A monitor is extended the full length of the building at the peak of the roof and is provided with louvres in the sides for ventilation. The buildings of the mill are thus all unusually spacious for structures of this type.

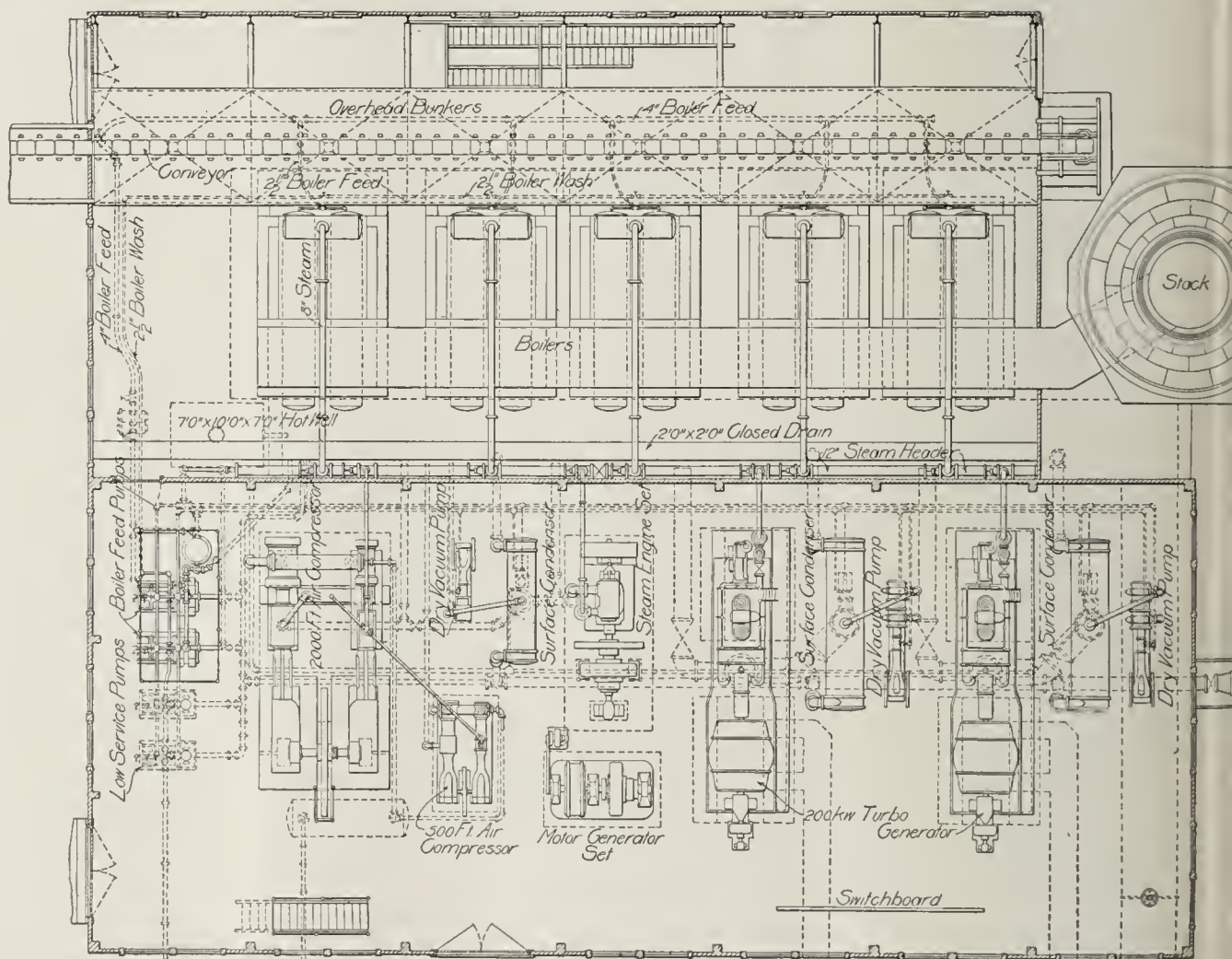
The dryer house contains two 6x60-ft. Allis-Chalmers rotary drying kilns, each gear-driven by a 10-h.p. motor. The bucket elevator to which the conveyor in the tunnel delivers from the row of blending bins raises the stone to two 500-ton storage bins over the charging ends of the dryers are each fired by a Roney mechanical stoker. Coal for these stokers is delivered to a hopper under the switch track at the side of the building, and is discharged from this hopper to an overhead horizontal screw conveyor by a bucket elevator, the screw conveyor delivering into either of two bunkers over the stokers.

Adjoining the dryer house is a building, 98x100 ft. in plan, in which the raw materials are finely ground, the two buildings being separated only 8 ft. The end of the raw-grinding building toward the dryer house contains a row of five 66-in. Smidth kominuters, with space provided for a sixth. In the opposite end of the building is a row of five 5.5x22-ft. Smidth tube mills. Each kominuter is gear-driven by a 50-h.p. motor, and each tube mill by a 120-h.p. motor. These motors are all in a space at the center of the building separated from the grinding machines by tight partitions, in order to protect them as fully as possible from the fine dust emitted by the machines. Furthermore, they all have specially designed housings which are practically dustproof. These housings are also provided for all the motors in the mill ex-

posed to the dust, as most of them are. In order to provide an additional aid in keeping the motors clean, compressed air is piped from the central power station to all parts of the mill, with a connection at every motor that has been installed, so the dust can be blown out frequently.

The rotary dryers in the adjacent house both deliver to an inclined bucket elevator, which extends through into the raw-grinding building and discharges there. This conveyor extends longitudinally over a row of five 300-ton supply bins above the kominuters, and is arranged to discharge

in which it is received into a hopper under the two switch tracks. A crusher is provided under each track so run-of-mine, or lump coal may be reduced. An overlapping gravity bucket conveyor extends transversely under the hopper in a horizontal run, then vertically up to the level of a trestle on which it is carried over the tracks to a circular steel storage bin, 26ft. in diameter and 26 ft. high, between the raw-materials grinding building and the building in which the coal is ground. This conveyor is arranged to discharge into the bin, or directly to a flight conveyor leading into the coal grinding house; coal stored in



Plan of Power House, Union Portland Cement Co.

to anyone of these bins. The output from the kominuters is carried by a horizontal 16-in. screw conveyor, in a small tunnel under the floor to an inclined bucket elevator at one end of the row. This elevator delivers at the top to a screw conveyor extending the length of a row of five 300-ton bins over the charging ends of the tube mills. The tube mills discharge their product on a screw conveyor laid under the floor the length of the row of mills; this conveyor delivers to a bucket elevator at one corner of the building and the elevator delivers in turn to a screw conveyor on a trestle that leads to a house around the charging end of the cement kilns, the latter being directly across the two railroad tracks at the side of the building.

The coal used in the cement kilns is unloaded from the railroad cars

the bin is raised to a flight conveyor by a bucket elevator.

The coal grinding house is 98x100 ft. in plan and contains a Cumber dryer, a Smidth kominuter and two 5.5x22-ft. Smidth tube mills. The Cumber dryer is driven by a 20-h.p. motor; the kominuter is gear-driven by a 50-h.p. motor and each of the tube mills by a 120-h.p. motor. All of these motors have the specially-designed dust-proof housings. The coal brought in by a flight conveyor is delivered to an overhead supply bin at the charging end of the dryer. The latter is fired with a mechanical stoker and delivers to a bucket elevator which discharges into an overhead supply bin for the kominuter. A bucket elevator carries the output of the kominuter to supply bins for the tube mills, and the pulverized coal from the latter is carried by a screw conveyor at the

ground level to a bucket elevator in one corner of the building; this elevator discharges on a screw conveyor on a trestle leading to the firing ends of the cement kilns across the tracks.

The three cement kilns which have been installed were built by the Allis-Chalmers Co. and have several unusual features of design. They are 8 ft. in diameter and 150 ft. long, and with the exception of houses over their ends, are not enclosed. Each kiln is carried at three points by ring bearings and is belt-driven through gears by a 50-h.p. direct-current motor in a small house at one side of the kiln. The

in plan as the one just described. Pulverized coal is fired into these ends, under an air pressure of about 100 lb. per square inch, from an overhead supply bin for each kiln, through either or both of two supply pipes. The clinker is discharged from each of the kilns directly into a 6x60-ft. cooler under the floor of the building. A spray of water is applied to the clinker in these coolers and the resulting steam is carried off by a stack outside the building, in order to prevent it from reaching the kilns.

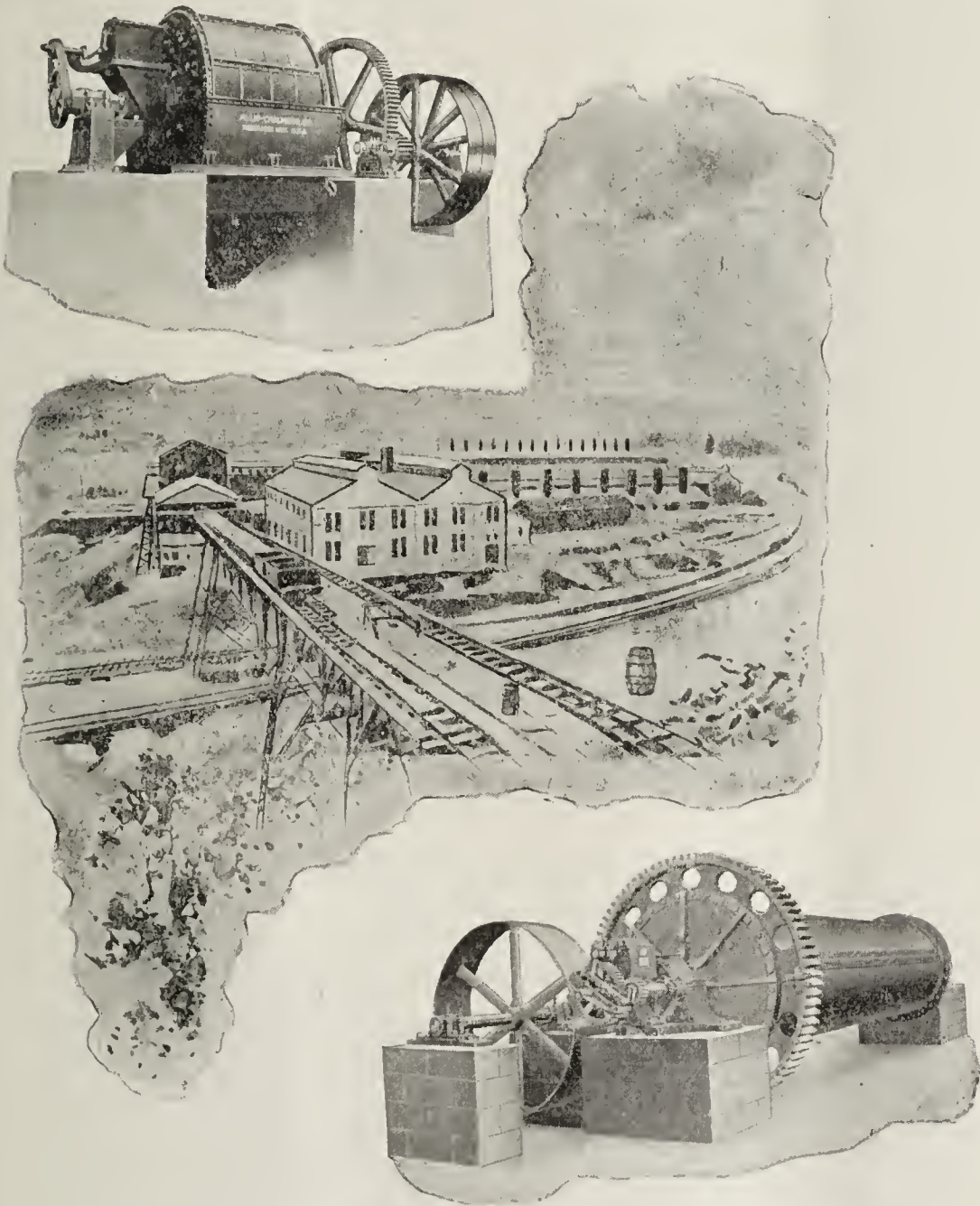
A clinker bin, 60 x 80 ft., in plan, is provided at the discharge ends of the kilns. An overlapping gravity-

over a row of five 300-barrel elevated storage bins in the building, and outside the latter is on a trestle. When the clinker requires seasoning it is carried through the building and back to the clinker bins, from which it can be drawn into the lower run of the conveyor as desired. Otherwise it is delivered directly from the kilns to the supply bins in the building.

The cement grinding building contains four No. 16 Lindhard kominuters with space provided for two additional ones, and six 5.5x22-ft. Smidth tube mills. The kominuters are each driven by a 50-h.p. motor and the tube mills each by a 120-h.p. motor. The arrangement of these motors is the same as those in the raw-grinding building. The conveying apparatus in this building is also arranged practically the same as that in the raw-grinding building. The finished cement from the tube mills is delivered by a screw conveyor, placed transversely under the outlet end of those mills, to an inclined bucket elevator that discharges at the top into a screw conveyor extending into the cement storage building, the two buildings being separated only 16 ft.

The cement storage building is 112x210 ft. in plan and contains three rows of circular steel tanks, with three tanks to a row. These tanks have a capacity of 3,500 barrels each, making the total storage capacity 31,500 barrels, and additional capacity for 70,000 barrels is being constructed. The screw conveyor from the cement grinding building extends over-head the length of the middle row of tanks, and has spouts leading to the tanks in all three rows. The cement is drawn from the bottom of the tanks through five automatic gates into a screw conveyor placed longitudinally under each row of tanks. These three conveyors all deliver at the same end to a cross conveyor, which delivers in turn to a bucket elevator; the latter raises the cement to the top of the building, where it feeds a screw conveyor that extends the length of a row of six elevated bins, each supplying automatic weighing and sacking devices. The filled sacks are loaded directly into the cars from these devices.

The central station from which power is supplied to operate the entire mill is complete and modern in every way. It occupies a separate building, 100 x 112 ft. in plan at one of the group of mill buildings. This station building is of the same con-



Gates Ball Mill and Tube Mill built by Allis-Chalmers Co.

right bearings each rest on rollers on a masonry pier without any housing. The shells of the kilns were especially designed to meet the long spans and other unusual conditions introduced.

The house around the charging ends of the kilns is 40x84.5 ft. in plan. In this house a supply bin for the prepared rock is placed over the end of each kiln; the masonry connection between the kilns and the stacks which serve them are also enclosed by the house.

The discharge ends of the kilns are in a building of the same size

bucket conveyor extends from this bin across the two railroad tracks between the kilns and the principal buildings of the mill to a 100 x 112-ft. cement grinding building. The lower horizontal run of this conveyor passes along in front of the discharge ends of the clinker coolers, where it receives the clinker directly from the latter, thence through a tunnel under the tracks and under the cement-grinding building, at the farther end of which it rises vertically and returns in an upper horizontal run to the clinker bins. This return run is carried

struction as the remainder of the mill buildings, and is divided on the longitudinal center line by a tight partition into a boiler room and an engine room, with reinforced concrete floors.

The boiler room contains five 500-h.p. Heine water-tube double-drum safety boilers in a single row. The furnace of each boiler is equipped with a Roney automatic stoker, supplied with coal by gravity from a separate overhead bunker holding about 125 tons. Coal is delivered to this row of bunkers from a hop-

per at the front with a 2½-in. washout connection. The supply line for these connections is furnished with water by either of two service pumps in the basement of the engine room, and is suspended from the under side of the floor of the engine and boiler room. Each boiler is also fitted with a blow-off connection which discharges into a closed box drain, 2 x 2 ft. in cross section, which is built in the basement of the boiler room, under the space in the rear of the boiler settings. This drain is contained trans-

versely under one end of the engine room and discharges into a waterway leading to the creek. The boilers each have an 8-in. steam connection to a 12-in. steam header suspended along the boiler

the steam header. The latter is also equipped with a gate valve so it can be divided into two sections. Each of the main steam-consuming units in the engine room has a separate connection to the header. The principal equipment of the engine rooms consists of the following units: Two 1,500-kw., 3-phase, 30-cycle Westinghouse turbo-generator sets; a 250-kw., 250-volt synchronous Fort Wayne motor-generator set; a 15 x 27 x 16-in. Westinghouse automatic vertical compound engine, direct-connected to a 240-kw., 250-volt direct-current Fort Wayne generator; a cross-compound two-stage Laidlaw Dunn Gordon compressor, having a capacity of 2,000 cu. ft. of free air a minute, and a smaller unit of the same type with a capacity of 500 cu. ft. of free air a minute. In addition to these main units is the necessary auxiliary equipment and apparatus.

The principal part of the load on the station is carried by either of the two turbo-generator sets, which are arranged in identically the same manner. Steam is supplied to the turbines at 200 lb. pressure, the units operating at 1,800 r.p.m. Each turbine exhausts through a 30-in. connection into a separate Alberger surface condenser set on the floor of the engine room. A 20-in. exhaust to the atmosphere is also provided by extending a connection from each turbine into the drain under the rear of the boiler room. Cooling water for the condensers is obtained from the creek and is delivered to the station under a head



Mill Buildings Looking from Quarry Hill.

per under the switch track along one end of the building by an overlapping gravity Link-Belt bucket conveyor. This conveyor extends from the track hopper vertically up to a trestle over the tracks, then horizontally on this trestle into the building and along over the elevated bunkers; at the end of the row of bunkers it drops vertically to a basement under the firing floor and in this basement has a horizontal run leading back to the track hopper. The ashes from the furnaces are also handled by the conveyor, which delivers them to an overhead storage bin close to the track end of the boiler room, so they can be loaded into cars readily.

The boilers are supplied with feed water by either of two 10 x 6 x 10-in. Fairbanks Morse boiler-feed pumps in the basement at one end of the engine room. These pumps draw from a 7 x 10 x 7-ft. hot well in the basement of the boiler room or from a Wainwright feed water heater adjacent to the pumps. A 4-in. connection is carried from the pumps under the floor to the firing room floor, and thence along under the latter, with a connection to each boiler. Each boiler is also provided

room side of the partition, on brackets, 16 ft. above the floor line. These connections are each taken from a chest over the front ends of the two boiler drums and have a gate valve at this chest and also at

of 12 ft. by a wood-stave pipe line, extending to the power house from an intake 2,700 ft. up the canyon; the cooling water is discharged into the drain in the boiler room basement, so no circulating pumps are



Mill Buildings Looking Toward the Quarry.

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required. The water of condensation is delivered from each condenser to the hot well in the basement of the boiler room by an 8 x 20 x 20 x 12-in. Alberger dry vacuum pump, also on the floor of the engine room at one side of the condenser.

The generator end of each turbo-generator unit is in a dust-proof case, designed specially for this installation. A circulation of air through the generator is obtained by connecting the interior of the case to the atmosphere by a 3-ft. x 3-ft. 4 in. duct under the floor of the engine room. The exciter for each of these generators is direct-connected to the end of the main shaft of the unit.

The 250-kw. synchronous motor-generator set supplies power to operate the direct-current motors in the mill and for incandescent lamps of the lighting circuits. As it is arranged it maintains the load factor of the station, but can be operated with the either side as a generator. The 240-kw., engine-generator unit is installed for service in case the motor-generator set is out of commission.

The engine of the 240-kw. unit and the two air compressors are operated condensing, a single Alberger surface condenser, with 1,800 sq. ft. of cooling surface, serving the three. The cooling water is circulated by gravity the same as in the larger condenser. A 6 x 10 x 14-in. Alberger dry-vacuum pump delivers the water of condensation from this condenser to the hot-well. Each of the three units served by the one condenser also has a separate exhaust connection to the atmosphere through the drain in the basement of the boiler room.

The large air compressor supplies air to force the powdered coal into the cement kilns. The smaller compressor is installed as a reserve to prevent a complete shut-down in case the large compressor is out of service. Both compressors deliver to a receiver in the basement of the engine room and air is piped from this receiver to every building in the mill for use in cleaning the numerous motors.

The operation of the various electrical equipments in the engine room and the distribution of power to the different buildings is controlled from a sixteen panel switchboard along one side of the room. This board has two panels at one end for the two-turbo generator units; next to these is a panel for the exciters of these units and then a totalizing panel with a recording

wattmeter and voltmeter. The next nine panels are each for a separate power circuit. Of the remaining four panels, one is for the exciters of the direct-current units, one for each of those units and the fourth is used for the lighting circuits.

Two 10 x 8½ x 12-in., cross-compound Fairbanks-Morse pumps supply water under pressure to a system of distribution mains extending to all parts of the mill. These pumps take suction from a sump which can be supplied from the gravity system, from the hot-well or from a sump in the drain under the boiler room. The exhaust from these pumps and from all of the auxiliary steam-consuming units is delivered to the feed water heater.

A thoroughly-equipped machine shop building, 50 x 112 ft. in plan and a 50 x 112-ft. store house building have been included in the mill, in order to provide as fully as possible for immediate repairs, since the mill is in such an isolated region that outside shops cannot be depended on for such work. The machine shop contains an 18-in. gap Putnam lathe, a Bickford radial drill, a 20 x 44-in. gap engine lathe, a 36-in. engine lathe, a 48 x 36-in. planer with a 12-ft. table, a pipe machine, a key seater, a bolt machine, a punch and shear, and various auxiliary small tools. All of this equipment is belt-driven from a line shaft by either a 20-h.p. direct-current or a 20-h.p. alternating-current motor, the two being provided so power will always be available. As unusually large supply of extra parts is kept in the store house, since the delivery of such parts from eastern manufacturers is slow.

A 40 x 65-ft. two-story and basement office and laboratory building, built of concrete, was erected ad-

jacent to the power house. The basement and part of the first floor of this building contain a very completely equipped laboratory for making all standard chemical and physical tests of the raw materials, clinker and cement. The balance of the first floor is given over to the offices. The top floor contains a drafting room and quarters for the superintendent and office employes. The company has also built a new town, about a mile down the canyon, for the mill operatives. All of the houses in this town are of concrete, and are supplied with water from a gravity system in the hills. Electric lights and a complete system of sewers are also provided.

The officers of the Union Portland Cement Co. are as follows: Messrs. C. W. Nibley, pres.; Jos. Scowcroft, Reed Smoot and M. S. Browning, vice-presidents; James Pingree, secretary and treasurer and O. B. Gilson, manager, The Engineering Record.

THE NEXT CHICAGO CEMENT SHOW.

Arrangements are under way for the second annual Cement Show. As there are various opinions as to the most appropriate time for holding this show, it will be the policy of the Executive Committee to meet the wishes of exhibitors and patrons by asking them to assist in selecting one of the following dates: Dec. 16 to 23, 1908; Jan. 4 to 10, 1909; Feb. 14 to 20, 1909; March 2 to 8, 1909.

The Chicago Coliseum, being obtainable on either of the above dates, the readers of Cement & Engineering News, are requested to make a first, second and third choice from the above dates and send the same to us on a postal card. This will enable the Executive Committee to select the most favorable date, for holding the cement show.

IMPORTS OF CEMENT INTO THE UNITED STATES.

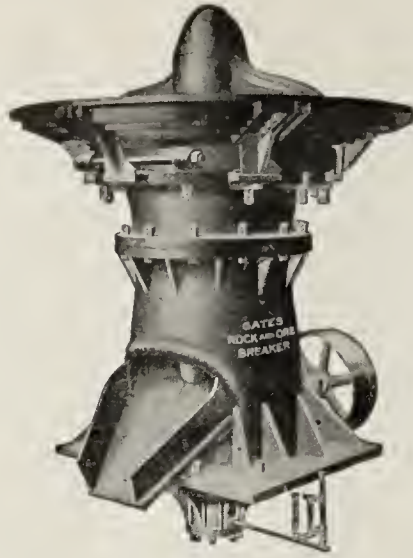
WHERE FROM	MAY				ELEVEN MONTHS ENDING MAY 30			
	1907		1908		1907		1908	
	Quantity in lbs.	Value in Dollars.	Quantity in lbs.	Value in Dollars.	Quantity in lbs.	Value in Dollars.	Quantity in lbs.	Value in Dollars.
United Kingdom . .	16,885,400	\$59,177	6,690,780	\$24,083	259,878,060	\$851,913	175,756,535	\$653,606
Belgium	16,830,048	49,793	1,103,580	2,902	315,714,931	978,182	143,267,732	455,112
France	1,004,200	3,180	297,600	1,276	14,779,518	55,616	11,403,527	43,879
Germany	11,090,807	49,974	3,012,265	11,105	406,543,918	1,280,305	210,960,364	698,670
All Other Europe . .	.....	.....	.....	.....	20,097,670	57,829	3,891,128	13,465
British North Am. .	.....	.....	1,750	15	3,106,983	22,686	278,290	1,643
Other Countries . .	927,423	5,025	2,600	30	55,886,578	264,631	5,709,547	30,110
TOTAL	49,737,878	167,149	11,108,575	39,411	1,076,007,658	3,511,162	551,267,123	1,896,485
Domestic Exports of Cement, bbls. . . .	64,500	103,176	83,016	131,259	615,467	1,011,944	860,431	1,345,336

There were 11,326,618 lbs. of imported Roman and Portland Cement, etc., in the United States bonded warehouses in May, 1907, valued at \$24,373, against 21,480,415 lbs. in May, 1908, valued at \$82,914.

For eleven months ending in May, 1907, there were 98,505 tons of asphaltum imported in the United States valued at \$405,534, against 118,937 tons imported in eleven months ending May, 1908, valued at \$461,636.

MAMMOTH AND WELL EQUIPPED PORTLAND CEMENT PLANT IN CALIFORNIA.

San Francisco, Cal.—The largest and one of the most thoroughly equipped cement plants west of the Missouri river is the new one of the Santa Cruz Portland Cement Co., which has its headquarters in this city. William J. Dingee is president of the company, which was organized about three years ago. It is capitalized at \$5,000,000 and a portion of the capital was utilized in the purchase of large tracts of clay and limestone lands in the vicinity of the plant, which has been completed at Davenport, Santa Cruz county, about twelve miles from Santa Cruz, on Monterey bay. The new cement town is reached by two lines of railway from Santa



Allis-Chalmers Style "K" Gates Breaker.

which has a capacity nearly double that of any other cement plant on the Coast.

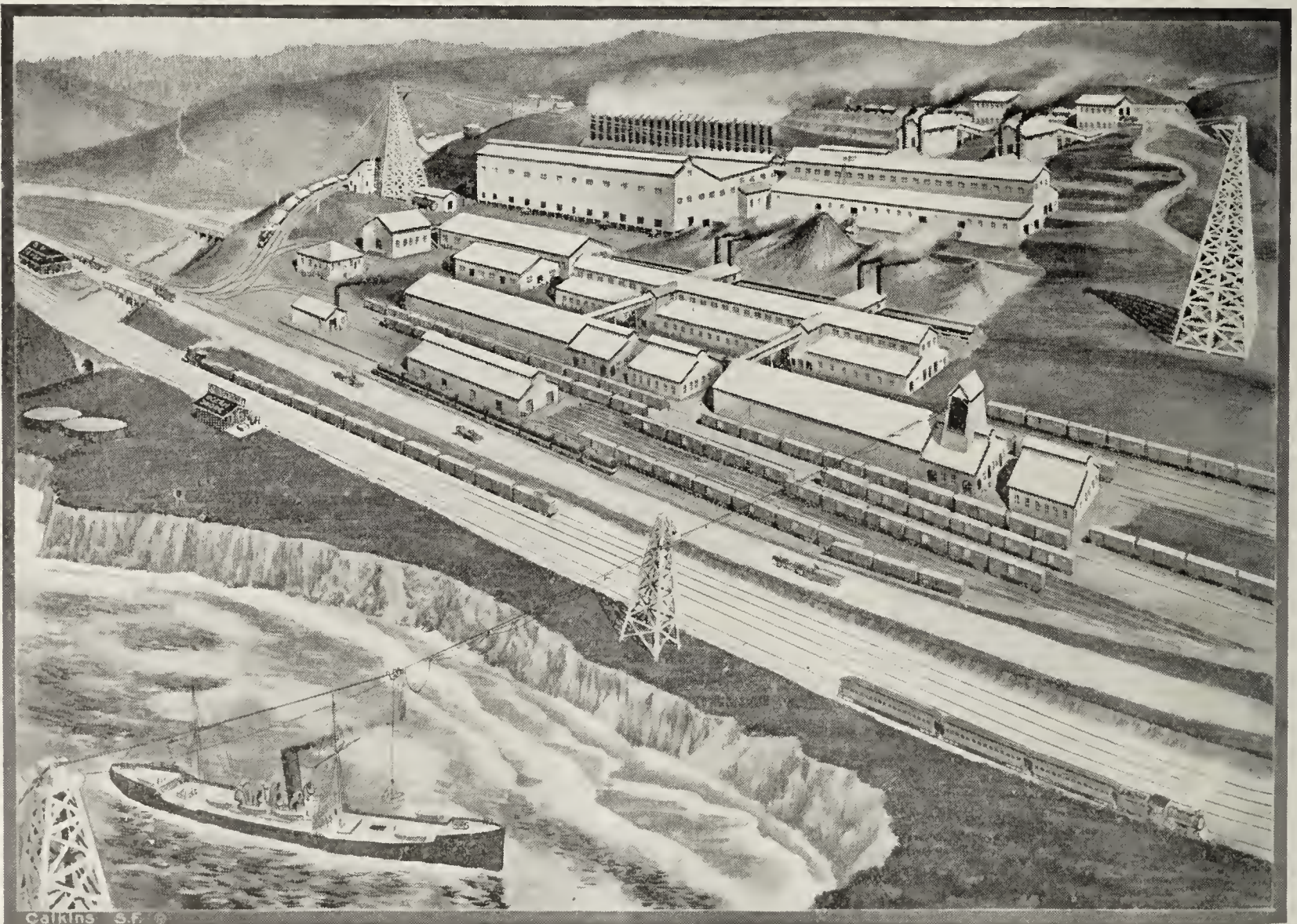
The already large and constantly

FLOATING CONCRETE CASSIONS FOR BREAKWATER CONSTRUCTION.

Maj. W. V. Judson, U. S. Engineer Corps, has invented and is constructing a number of reinforced concrete cassions to be used in the construction of a breakwater at Algoma, Wis. These cassions are 26 feet long, 15 feet wide by 13 feet deep. They are built on land and launched and floated to the place on the line of the work and filled with stone and sunk in place and covered with a concrete top, one section at a time is thus built up.

This method is a distinct improvement over the old manner of constructing breakwaters and piers, besides which they are much cheaper. Maj. Judson is the inventor of the plan of launching them.

The idea is not new, as early as



Santa Cruz Portland Cement Co.'s New Plant.

Cruz—the Southern Pacific and the Ocean Shore line.

Although the big plant was completed in its entirety only a short time ago, portions of it have been running for more than a year. When only a portion of the plant was being operated the average daily output was close to 5,000 barrels of cement and now that the whole factory is in working order, they are turning out about 9,500 barrels. From 600 to 800 men are to be given employment in the mill,

growing demand for cement in this state promises a steady and profitable market for the big plant's output.

"The equipment in this plant was furnished by Allis-Chalmers Company, Milwaukee, Wis., and consists of the following:—42-5 feet 6"x22 feet, tube mills, 32 No. 8 style "B" Ball Mills, one No. 9, four No. 6 and 2 No. 5 Gates Breakers."

1900 the U. S. Government and the Fitchburg Railway Company jointly constructed floating cribs built on land and floated in place for constructing a dock at the Charlestown Navy Yard, Boston, Mass., the same was illustrated and described in the Cement & Engineering News, in July, 1900. The work was done under the supervision of the U. S. Engineer Corps.

R. J. Kellogg, manager of the Superior Portland Cement Company, Baker, Wash., says: "We ex-

pect to have our plant in operation during the latter part of July or early part of August. The capacity of the plant is 1,500 barrels per day; materials, limestone and clay; size of Mosser kilns (three), 7 feet 6 inches x 125 feet. The clinker side is equipped with Power & Mining Machinery Company's ball tube mills for preliminary grinders and tube mills in connection with Emerick air separators for finishing. Raw side is equipped with No. 6 McCulley crusher, Williams mills for preliminary grinding and Power & Mining Machinery Company's 6x22 feet tube mills for finishing the raw material preparatory to kilns. Our mills are all independent electrical driven throughout the plant, which is equipped with Westinghouse motors, the power plant being located eight miles from factory site, it be-

our future extensions here. We have our own town site and sufficient cottages to take care of our workmen as well as our own town water and lighting system.

VIEW OF CEMENT PLANTS FROM MID-AIR.

The illustration below shows plants Nos. 3 and 4 of the Universal Portland Cement Company, located at Buffington, Ind., 22 miles from Chicago, near Lake Michigan.

They are on the C. L. S. & E. R. R., which connects all roads running out of Chicago. The plants adjoin each other, and practically form one large plant, although they were built at different times, and are operated separately.

Plant No. 3, which is the one in the foreground, was built in 1904

Both plants are operated entirely by electric power, generated by waste gases from the blast furnaces of the Illinois Steel Company at South Chicago, and transmitted by means of high tension alternating current which is transformed at the plants for distribution.

The illustration was made by the George R. Lawrence Company, with their aerial photographic apparatus. This apparatus is composed of a series of aroplanes by means of which the camera is elevated to the necessary height, the controlling device by which the camera is held rigid in the air during the time the exposure is being made, and the electrical device for making the exposure.

The aeroplanes are each eight feet square, and have a wind surface of 60 square feet. It is usual in mak-



Bird's-eye View of the Plants of the Universal Portland Co., near Chicago.

ing a water power proposition of 10,000 horsepower available. Present unit equipped with two 750 K. W. generators, 3-phase, 60-cycle system generator, 12,000 volts which is stepped down to 550 volts at the plant and generating power being supplied by two Pelton water wheels. The personnel of our company is as follows: J. C. Eden, president; George W. Dickinson, vice-president; Mott Sawyer, secretary; Puget Sound National Bank, treasurer; R. J. Kellogg, manager. Our plant is laid out for 5,000 barrels per day and as soon as the present unit, 1,500, is started arrangements will be made for future extensions up to capacity mentioned. We are obliged to use oil for fuel in our kilns, and dryers at the present time but plant is laid out for coal burning installation as soon as sufficient coal is available to warrant our supply. The original capitalization of our company was \$400,000, which was increased on June 1st to \$1,000,000 to enable us to proceed with

and was started on January 1, 1905. This plant contains 16 kilns, 90x7 feet, and has a daily output of 5,000 barrels of Universal Portland Cement. The stock house has storage room for 310,000 barrels.

Plant No. 4 was started on October 27, 1907. This plant contains 12 kilns, 120x7 1-2 feet, and has a daily output of 6,000 barrels. The stock-house is one of the largest in the country, being 560x100 feet, and holds 400,000 barrels.

ing exposures at an altitude of 1,000 feet to use from 12 to 18 of them. They are sent up one after another, dragging a cable until the lifting strength is strong enough to carry the combined weight of 3,000 feet of cable and the camera with its series of weights and electrical appliances.

When the camera is 1,000 feet high, the top aeroplane is 3,000 feet high, or practically out of sight. The lowering apparatus is operated by a three-horse power gasoline motor.



Allis-Chalmers Rotary Kiln, with Taper End for Dry Process.

The man who makes the picture, remains on the ground. He watches the camera with a strong field glass, and has his finger upon a switch, which controls the electrical device for making the exposure.

It may require one, two, or possibly three hours to convince him that the right moment has arrived to press the button. The instant the shutter is released a miniature parachute escapes from the apparatus notifying him that the exposure has been completed and that the apparatus can be lowered and be prepared for another ascent if necessary.

"The initial equipment in this plant was made by the Allis-Chalmers Company, including ball mills, tube mills and kilns."

CORRUGATED BARS FOR REINFORCED CONCRETE CONSTRUCTION.

The permanence and reliability of concrete reinforced with the Corrugated Bar, not to mention the economy that can be effected in most cases, make it especially desirable for public improvement work, and, in fact, for all construction when the above qualities, combined with practically no maintenance charges are to be considered. One of the great advantages of reinforced concrete, making it especially suitable for waterworks constructions and long retaining walls, is that, when properly reinforced, it will not develop cracks from shrinkage, temperature or other contributory causes. The high elastic limit and great bonding value of the Corrugated Bar makes it beyond question the best and most economical reinforcement for such use.

The illustrations following are intended to show a variety of structures in which the Corrugated Bar

was used, and we have endeavored to select typical constructions rather than striking or imposing works.

The foundations are the most important part of any structure, and special care should be used in their designing. In cases where poor soil or heavy loads require extended footings or possibly a raft over the entire site, reinforced concrete construction will be found to be peculiarly suitable. Great concentrations of loading and resulting heavy shearing stresses necessitate the use of a mechanical bond bar in this class of work. The Corrugated Bar

where considerable spread is required, a reinforced concrete design, is more economical than either a stepped concrete pier or an I-beam grillage. An isolated column footing used in the Syndicate Trust Building, St. Louis, is shown in figure 1, on the following page. This footing, while 16 feet square and carrying a load of 580 tons, is but 3 feet thick.

An example of a double footing used in The Times Building, St. Louis, is shown in Figure 2. In this case the center line of the wall column is but 16 inches back from

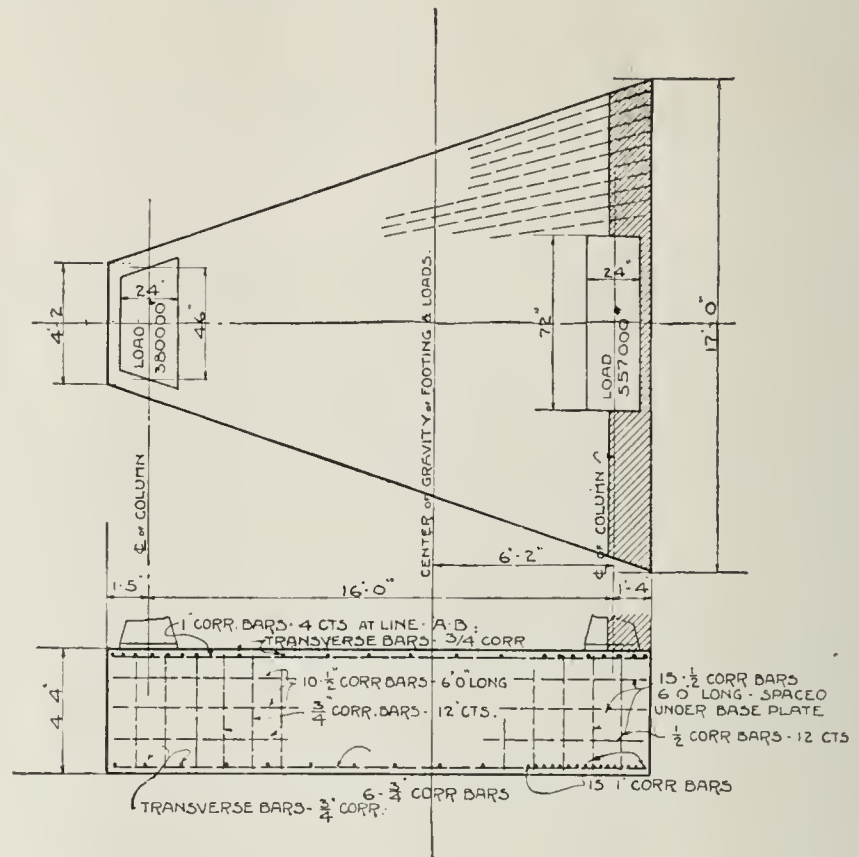


Fig. 2.

has greater bonding value than any other bar on the market, and in addition, water (and most footings are more or less subjected to its action) does not affect its bond with the concrete.

For isolated column footings,

the property line, and it was necessary to use a "cantilever" arrangement. The dimensions of the footing were so chosen that its geometrical center of gravity coincided with the resultant of the column loads, thus insuring a uniform soil pressure. The footing was figured as a plate supported by the column bases, and subjected to the upward pressure of the earth. The simplicity of this design as compared with the ordinary steel girder cantilever construction is to be noted.

In no class of reinforced concrete construction does the question of vibration and shocks and consequent apprehension as to the destruction of the adhesion between the concrete and steel enter so largely as in railroad work. It is not surprising, then, that railway engineers were among the first to recognize the many advantages of the Corrugated Bar, and that it is now considered the standard of excellence, which other forms of bar reinforcement vainly strive to approach.

The subject of reinforced concrete construction was discussed at the

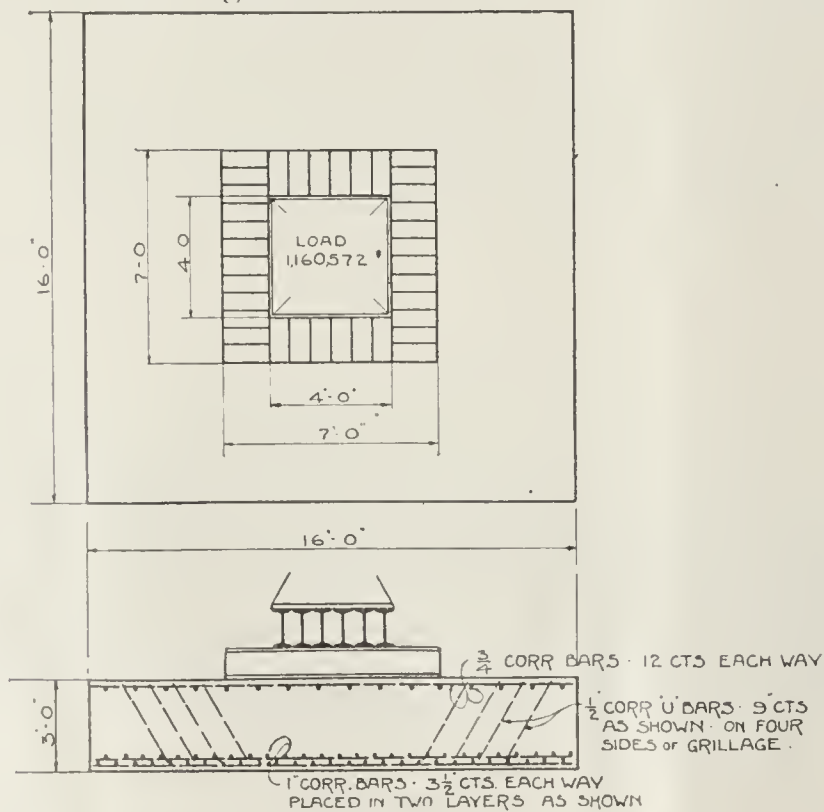


Fig. 1.

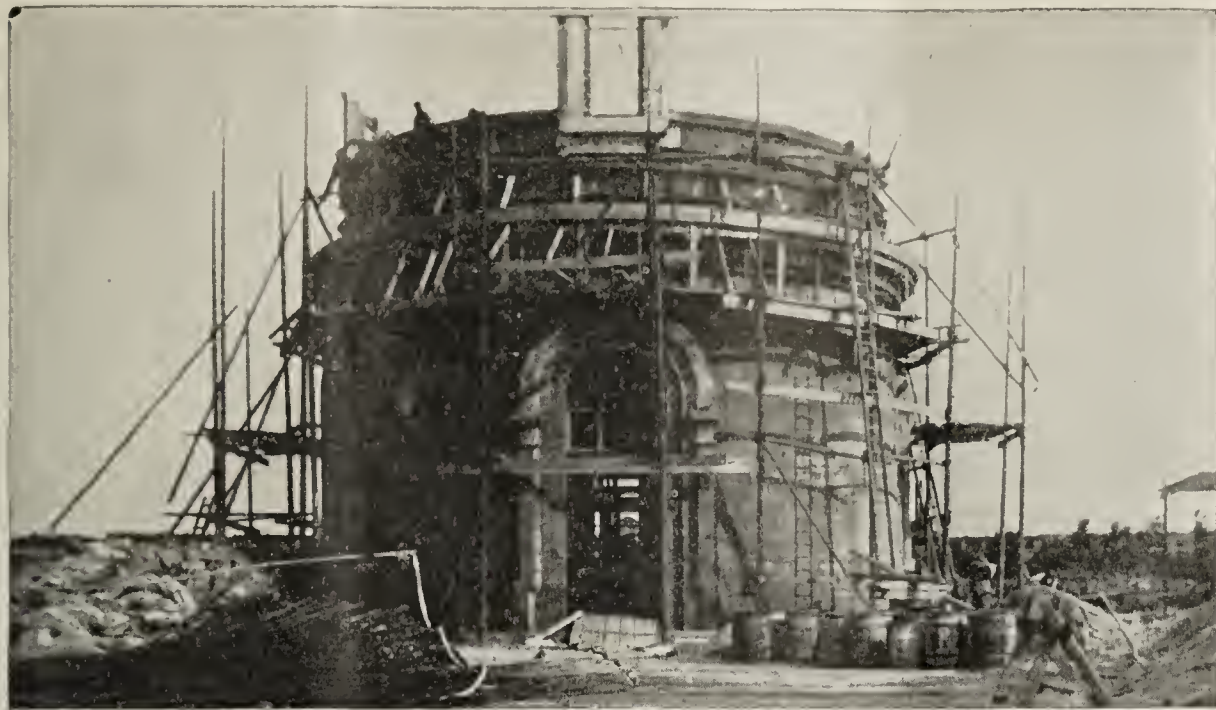


Fig. 4.

Seventh Session of the International Railway Congress, held in Washington, D. C., May, 1905, and resolutions in favor of such construction were adopted. We quote one paragraph:

"Railroad practice shows that carefully built reinforced concrete structures give excellent service and require almost no maintenance. For this reason the use of reinforced concrete should be recommended, even if the cost of construction should, exceptionally, be higher than for another system of construction."

In railroad work it is also often necessary to develop the full stress in the reinforcement in a short length of bar, and we wish to call the attention of railroad engineers to the superior bonding value of the Corrugated Bar, as evidenced by the recent tests on bond made by Prof. C. T. DePuy. The preceding sentence applies not only to the main reinforcing bars, but with equal force to shear members, stirrups, etc., and especially so as the length of these secondary members is restricted in most cases by the depth of the beam.

The following illustrations are typical and show the adaptability of Corrugated Bar reinforced concrete construction to all classes of railway work. We desire especially to call attention to the growing popularity of reinforced concrete trestle work, and short span, flat slab girder designs for permanent way construction. See Fig. 3.

Fig. 4, shows building in process of construction, corrugated bars being used. The grade of this class of work is done by the Expanded Metal & Corrugated Bar Co., St. Louis, Mo.

THE USE OF REINFORCED CONCRETE IN THE CONSTRUCTION OF PENSTOCKS.

A comparatively new and relatively untried opportunity for the use of reinforced concrete is presented in the construction of penstocks for the conveying of water, frequently under considerable head. A recent investigation conducted by Mr. Leonard C. Wason, President of the Aberthaw Construction Co., of Boston, throws an interesting light upon the subject. He was particularly anxious to learn whether expansion joints would be necessary with this form of construction. Literature upon concrete construction was carefully scanned as regards authoritative statements. A typical competent authority for the theory stated that reinforced concrete can be built of indefinite length if properly reinforced, and be free from shrinkage, owing to temperature and settling stresses.

Not content, however, with such a general statement, Mr. Wason sought the personal opinions and experiences of various engineers. Their replies are interesting as they are varied.

An engineer experienced in concrete and hydraulic work showed a drawing of penstock of curved section with flat base, laid out for continuous reinforcement from end to end without expansion joints. He emphasized the necessity of standpipes for taking care of water hammer air pressure and vacuum. After careful investigation he stated his belief that a penstock without joints but of proper shape with sufficient longitudinal reinforcement is practical and would prove satisfactory.

A learned engineer stated that he had reported adversely on a proposition for building a 300 ft. rein-

forced concrete penstock. He was afraid of seepage and freezing.

An engineer experienced in government work believes that if properly designed a penstock could be built of reinforced concrete without expansion joints.

The president of a large manufacturing company had had experience with a steel penstock 15 feet in diameter and 300 feet long which crawled 3 inches and tore loose from the dam.

Although the chief engineer of a mill engineering firm had no direct knowledge of reinforced concrete penstocks, he had had trouble with those built of steel. These he had to cover.

An engineer experienced in the building of sewerage disposal works believed that such penstocks could be built with success, and that the leakage would be small; also that it would be essential to cover the concrete mass sufficiently to equalize the temperature.

Mr. Wason's conclusion was that it is feasible to build a penstock of reinforced concrete without joints, that care would have to be taken to make proper bond between days, work, and that even with this care slight leakage would be likely to occur at these joints when the penstock was first put into use. His experience in the matter of subsequent closing of leaks came largely from the building of the notable standpipe at Attleboro, Mass. This is 50 feet in diameter with 100 ft. water head. When first built it leaked, but an application of the "Sylvester Solution" to the inside stopped all leakage and today the pipe is tight. He believes that in order to get these results it is necessary to have a proper design and very careful workmanship. He believes further that the friction on the ground would localize shrinkage and that there would be no trouble from crawling such as occurs in a steel pipe. In fact that when once built the pipe would require no attention and would be practically permanent.

The farmers in the vicinity of Missouri Point, north of St. Charles, two years ago, built a levee along the Missouri river, which was swept away by the high water during the spring, the levee having been weakened by muskrats working through the earth work, flooding thousands of acres of fertile land. The levee is to be built over again, with a continuous cement slab in center of the earth levee, this will prevent the muskrats from working through the embankment.

BOOK NOTICES.

NEW MIRACLE CATALOGUE.

The Miracle Pressed Stone Co., of Minneapolis, Minn., have just issued their handsome new Miracle Concrete catalogue for 1908-1909. A great deal of time and money has been spent in preparing this catalogue, which contains 144 pages and takes up their full line in detail, is completely illustrated, and is a thor-



ough book of instructions and full information for anyone who is interested in this great industry. The operators of the various machines are fully described, and the book illustrated with many cuts of up-to-date buildings, showing not only outside views but floor plans as well. In connection with the sewer pipe department, there has been taken up in detail the making of all special pipe Ts, Ys, and connections which are illustrated, so that no one need go astray on the subject. In fact we believe it is the most complete book of its kind that has ever been issued by any concern advertising concrete machinery. The accompanying cut shows the cover of this catalogue, which will be sent to interested readers, upon receipt of 25cts.

Curves for Calculating Beams, Channels and Reactions. A Manual for Engineers, Architects, Designers, Draughtsmen, Builders and Contractors, by Sidney Diamant, E. E., Structural Engineer. 40 pages, 25 full page plates, 3 illustrations. Price \$3.00.

This manual, containing twenty-five absolutely reliable graphical charts for giving quick results, and entirely obviating intricate calculations, is a time-saver for structural engineers. Thirteen charts give the relations between size of I-beams or channels, spacing, span and loading, and covering the whole range of commercial sizes for spacings between 1 foot and 6 feet 6 inches,

spans between 5 feet and 40 feet, and loadings between 80 and 500 pounds per square inch. Twelve charts give reaction curves for spacings between 1 foot and 6 feet 6 inches, spans between 4 feet and 40 feet, and loadings between 80 and 400 pounds per square inch. These charts are small enough to be convenient in handling, and yet large enough to permit of easy reading.

CEMENT SIDEWALK MACHINE.

Mr. Ernest S. Ransome, No. 11 Broadway, N. Y., has invented and placed upon the market a machine for constructing cement sidewalks, which does away with the ordinary skilled labor usually required in building cement walks. The machine consists of a traveling frame or mold of the width of the walk to be laid and about five times as long as the width of the walk. A hopper is mounted on the mold the full width of the travelling mold all as shown in our illustration. After the filling for the walk is in place, the mold is placed on the filling. The coarse concrete for the base of the walk is deposited into the front portion of the mold and the mortar or finish for the top is deposited in the hopper. A pulley block with a hoop is connected up to a clevis in the front end of the machine and by means of a winch and cable the

The machine is controlled by the Ransome International Conduit Co., No. 11 Broadway, N. Y., who will give any additional information desired on application.

INCORPORATED.

The Guthrie Mountain Portland Cement Co., of Mapleton Bourbon Co., Kan., against which bankruptcy proceedings were filed, has paid up its indebtedness and will be discharged. The company is to be re-organized and make a new start.

The Dakota Portland Cement Co., of Sioux Falls and Chamberlain, S. Dakota has elected the following officers:

H. H. Gulstine, president of Madison Lake Co., S. Dakota; D. B. Zimmer, vice president and general manager; C. J. Bach, treasurer; T. F. Cole, secretary.

Mr. Bach is president of the Bank of Hurley, Turner Co., S. Dak.

Mr. Cole was formerly connected with the National Bank of Commerce, of Kansas City.

"We are working a little over 100 men on the construction work of our plant and have our buildings about 50 per cent erected," says O. M. Connet, president of the Monarch Portland Cement Company,



The Ransome Cement Sidewalk Machine.

traveling mold is moved forward at the rate of two feet per minute. The forward movement of the machine compresses the concrete in the mold, while the finishing coat or surface distributes and finishes the top equal to first class hand float work. The machine can likewise be used for making concrete slabs. These slabs may be reinforced with expanded metal steel rods or wire mesh. It can be adapted to the construction of concrete lintels, fence post, coping, railway cross ties, as well as other concrete products having a uniform cross section.

Humboldt, Kansas. "We expect to be in operation by about Christmas. We expect to use electric drive throughout the plant and are in every way possible making this a modern mill."

C. J. Crawford, secretary of the Cape Girardeau Portland Cement Company, Cape Girardeau, Mo., says that the greater part of the financing of this company has been completed and it is believed the construction of the plant can be commenced about August 1. "We shall probably have four kilns, each 8x125 feet," said Mr. Crawford re-

cently. "This mill is very advantageously located to the great fields of southern Illinois by rail or boat, as well as the coal district of western Pennsylvania, being less than forty miles above the mouth of the Ohio river. The company will use complete electrical transmission of power, and will build a plant as modern as careful investigation and experience can produce. The company is capitalized at \$1,500,000, and owns at this time by outright purchase and also controls through lease and option large and valuable tracts of Trenton limestone very similar in nature to the Lehigh Valley district of Pennsylvania. For the most part our lands are on the shores of the Mississippi river and in immediate vicinity of the great Thebes bridge across the Mississippi river, which assures us of extraordinary railroad facilities." Mr. Crawford has had an extended experience in the material trades, both in their sale and manufacture, having been more prominently connected in the growth and development of the plaster industry at Fort Dodge, Iowa, and will take personal charge of the engineering features of this work.

"It will probably be October before we will be making cement," says Chas. H. Apple, of the Great Western Portland Cement Company, Kansas City, Mo. "When our mill is completed it will have a daily capacity of 4,500 barrels. We are well under construction and pushing forward as fast as possible. We were unfortunate enough to have our mammoth 1,800 horsepower engine caught in fourteen feet of water in Armourdale, Kansas, during our late flood, which will delay us a few days."

Articles of incorporation have been filed by the Western Portland Cement company, with a capital stock of \$2,000,000. The incorporators are F. R. Clark, A. R. Torrelle and P. N. Clark, the first and last being of Clark Brothers, mining brokers. The incorporators will not at present definitely locate the site of the proposed plant or discuss their plans, further than to say that their cement beds are in Washington.

Miracle Waterproof Cement & Stone Co., Elizabeth; to manufacture waterproof cement and building blocks, building cement, builders, contractors, etc.; capital, \$10,000. Incorporators: John Ferdon, J. W. Goodliffe, J. W. Goodliffe, Jr., all of Elizabeth, N. J.

A reinforced concrete railway tie, invented by E. N. Davis of Lodi, Wis., is being tested on the Chicago Milwaukee & St. Paul Ry. All wearing parts and edge are reinforced by steel bars.

The Texas Railway Commission has amended Tariff No. 36 as follows:

Cement, in carloads, between Texas City and points on the International & Great Northern Railroad, shall be made by adding 2c per 100 pounds to the rates applying between Houston and such International & Great Northern points.

This order shall take effect July 1, 1908.

Secretary of War Taft on June 30th granted a hearing to Pacific Coast cement manufacturers and dealers who requested that a portion of the 4,450,000 barrels of cement to be purchased for use on the Panama Canal be bought from Pacific Coast dealers.

Frank P. Freeman of California, representing the Pacific Coast cement interests, asked that the bids of Pacific Coast cement manufacturers and dealers be given consideration in spite of the fact that they were about 25 per cent higher than the bids received from eastern cement companies. Secretary Taft decided that under the law, he is obliged to award the contracts to the lowest responsible bidder without regard to geographical considerations.

C. R. Shaw of Ogden, Utah, signed a contract with D. C. McWaters of the Twin Falls Land and Water company of Twin Falls, Cassia Co., Idaho, for the construction of a cement dam, which will require the use of 65,000 barrels of cement. The contract price will approximate \$260,000.

Fargo, N. D.—The Fargo Cornice & Cement Co., has been incorporated with a capital stock of \$75,000 by M. E. Rusk, Geo. Rusk, H. G. Given, all of Fargo.

The Dakota Portland Cement Co., incorporated under the laws of South Dakota by Chamberlain & Sioux Falls, S. Dakota. The works are to be located at Chamberlain. General offices of the company are at Sioux Falls, S. Dak.

The Janesville, (Wis.) Cement Shingle Co., are filling an order for roofing a large Chicago school house.

The Victorville Portland Cement Co., has located a deposit of cement raw material 11 miles from Victorville, San Bernardino Co., California. The officers are: F. H. D. Banks (Pres.); F. H. Merrill, Sec.; J. S. Meacham, Director; Prof. W. S. Trueblood, Chemist. A railroad has been surveyed from Victorville to the deposit with 2 per cent grade, which will give a gravity road from the deposits to Victorville. A meeting was recently held at the board of trade rooms at Pasadena to further the construction of this road. Victorville is located directly east of Pasadena in the San Bernardino range of mountains, 31 miles southwest of Barstow on A. T. & Santa Fe Ry.

The American Concrete & Engineering Co., of Spokane, Washington, capital \$200,000. J. C. Adams, G. S. Adams & R. L. Battan, Incorporators, all of Spokane.

The Erie (Pa.) Concrete Brick & Block Co., has been organized, Alfred Gunnison, Pres.; Chas. Wilson, Vice Pres.; Adam Karch, Sec. and Treas.; Holger Rommerdale, General Manager; F. R. Botsford, Supt. of works.

Isaac N. Payne, treasurer of the Marengo Portland Cement Company, Detroit, Mich., says in regard to the purchase by his company of the plant of the Iroquois Portland Cement Company of Caledonia, N. Y., that the plant will be repaired and enlarged under the supervision of Leigh Hunt, who expects to have it ready for operation in about sixty days. The president of the company is H. C. Hamilton of Youngstown, Ohio; secretary and treasurer, Wm. J. Thompson of Youngstown, Ohio; vice-president, John Sherwin, of the First National Bank of Cleveland, Ohio. The general offices of the company have been removed to Youngstown, Ohio. The Michigan office is at 603 Whitney building, Detroit, Mich., under the supervision of Mr. Payne.

W. W. Thompson, secretary of the Mobile Portland Cement Company, says that the new company, about which the papers have been saying so much of late, will be called the Mobile Portland Cement & Coal Company, with a capitalization of \$6,000,000 and they are authorized to issue \$3,000,000 of bonds. He also states that the company will have no preferred stock. William J. Oliver, the Knoxville contractor and manufacturer, has become largely interested in this

company and will be one of the leading spirits and have charge of the development of the properties. The Mobile Portland Cement Company will hold a meeting in the near future to ratify the actions of William W. Thompson and John R. Markley in the deal made with Mr. Oliver and his associates.

Mr. Thompson said: "Mr. Oliver will have associated with him some of the strongest men in the East and the directors of the company at Mobile will be very largely interested in the proposition and will remain on the board of directors. The Mobile Portland Cement Company owns 1,768 acres of the best cement property in the South. These lands are located at old Fort St. Stephens on the Tombigbee river, where they have three miles of river frontage. They expect to use the soft stratum of limestone in the manufacture of their cement. This stratum is sixty feet deep and can be handled by steam shovel. The plant will have a capacity of 3,000 barrels of cement per day. This is to be one of the most up-to-date plants that was ever built in the United States and will be first class in every particular.

"Adjoining the cement lands the company owns leases on 4,000 acres of oil and gas lands, where they believe that they will get enough natural gas to run the cement plant for a number of years. This oil and gas proposition is, of course, a gamble, but the surface indications are as good as at any oil field that has ever been developed—Beaumont, Sour Lake, Batson or Jennings, La. The company also owns 19,500 acres of coal lands in Jefferson and Tuscaloosa counties, right in the very heart and centre of the Great Warrior coal basin. These lands control fifteen miles of river front on the east side and nine miles of river front on the west side.

"The Moline Portland Cement & Coal Company will build four river tow boats and forty barges and will barge the coal from the mines to Mobile. The dust coal will be used at the cement plant which will use about 300 tons per day. The rest of the coal will be marketed in Mobile and New Orleans and a great deal of it will be handled in Cuba.

"Mr. Oliver has spent a great deal of money trying to find a good cement location and was anxious to become interested in the cement business, as he is one of the largest contractors in the United States and at present is doing a great deal

of work in Cuba. His work is increasing day by day and the demand for cement is increasing hourly, and by being at the head of a large cement corporation he can be certain of what his cement will cost.

Articles of incorporation have been filed with the county auditor by the West Portland Cement company, the capital stock being named as \$2,000,000. A. E. Torelle, F. R. Clark and R. N. Clark are the incorporators.

New York, N. Y.—The Knickerbocker Portland Cement Company has been incorporated with a capital stock of \$10,000 for the purpose of manufacturing Portland cement. D. Baker, Yonkers, N. Y., Thos. F. Barrett, 37 Wall St., New York, and other incorporators.

W. A. Murray & Ella M. M. Babbitt of Sanford, Florida, have invented a cement pipe molding machine for producing 3 in. drain tile.

The National Portland Cement Co. owns a tract of land near Kendall, Whatcom Co., Washington. R. A. Williams of Owen Sound, Ontario, is the chief promotor of this enterprise. The material on the land at Kendall was purchased several years ago by Balfour Guthrie. The mill site may be located either at Bellingham or Kendall, both in Whatcom County. R. M. McWilliams, assistant engineer, has been gathering data to be submitted to his brother, the Chief Engineer of the company.

Samples of the raw materials have been shipped east for examination and report. P. H. McWilliam is making his headquarters at Bellingham, Wash. for the present.

The Colossus Cement Company, with an authorized capital of \$4,000,000 was incorporated at Trenton, N. J., May 18, to manufacture cement. The incorporators are William H. Williams, F. Winthrop White and Robert V. Kelly, all of Jersey City.

Mr. W. A. Aiken, M. Am. Soc. C. E., for the past eight years General Inspector of Material on the staff of the Chief Engineer of the Board of Rapid Transit Railroad Commissioners of the City of New York, in charge of the inspection of all materials entering into the construction of the Subway, having become associated with us, we beg to announce the corresponding increase and extension of our laboratory fa-

cilities and organization for the inspection of the manufacture, and testing, chemically and physically, of all structural materials used in the Engineering Arts and Manufactures.

Mr. Aiken will give his personal attention to all inspection, and commands the services of his former corps of expert inspectors, who, in connection with the regular force of this Company, are prepared to undertake the inspection both at the mills and shops, as well as in the field when necessary, of structural steel, bridges, buildings, rails, railroad equipment, cast iron, cement, asphalt, paints, paving brick, etc., together with any and all chemical work.

With resident inspectors located, as occasion demands, at all points of manufacture, and a fully equipped cement testing laboratory at Easton, Penna., in the heart of the Lehigh district, in charge of a competent representative, we are in position to assure the shipment of only such materials as comply with the specifications, and we solicit your patronage for the highest class of engineering inspection.

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The Gulf Portland Cement Company, composed largely of Philadelphia capitalists and manufacturers, announce their intention to begin the immediate construction of a cement plant at Ragland, St. Clair County, Alabama, at a cost of \$1,500,000. According to present plans the plant is to be completed and in operation before the end of the year. The company has purchased and paid for large tracts of real estate in and near Ragland, containing coal, lime, slate, and all raw materials entering into the manufacture of Portland cement. Extensive water privileges have been acquired and will be used. The capacity will be something like a train load of cement per day. The plant will be located on the Seaboard Air Line railway.

The Concrete Power Brick Co., Boston, Mass., capital \$100,000. Frederick Allen, Wm. G. Burns and other incorporators.

A new waterproofing material in the form of sheet-copper foil is being introduced in India. It is used the same as wall paper. It is both damp and insect proof.

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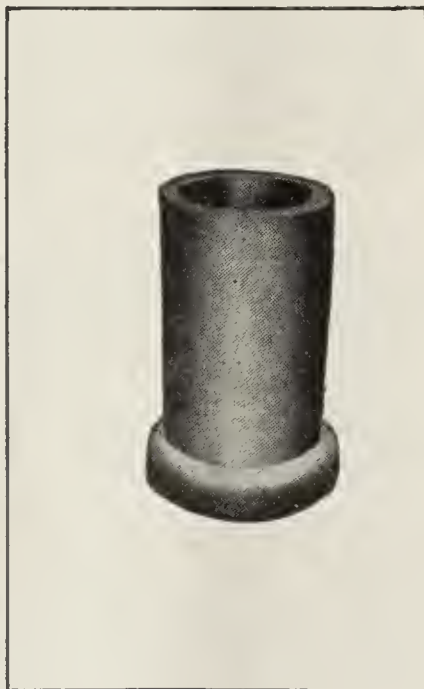
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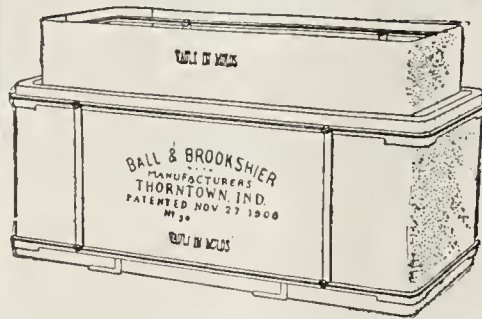
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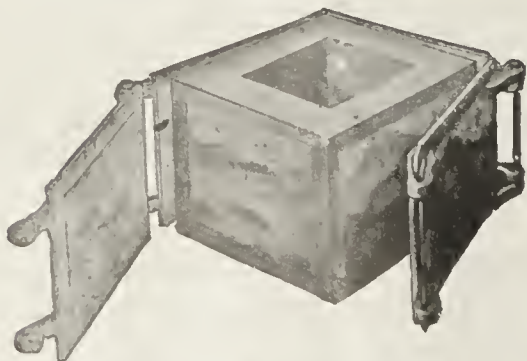
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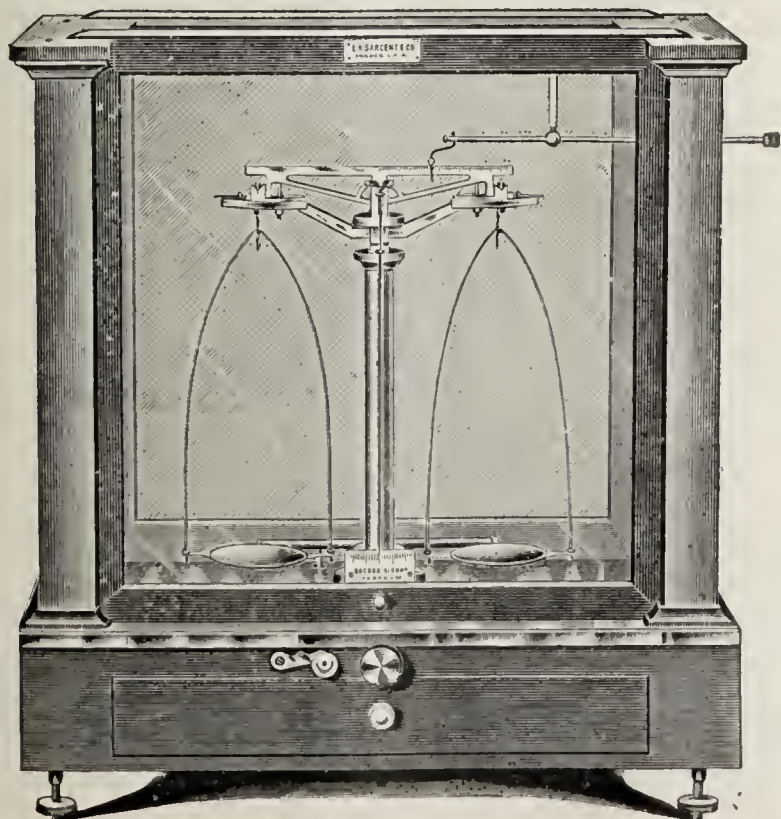
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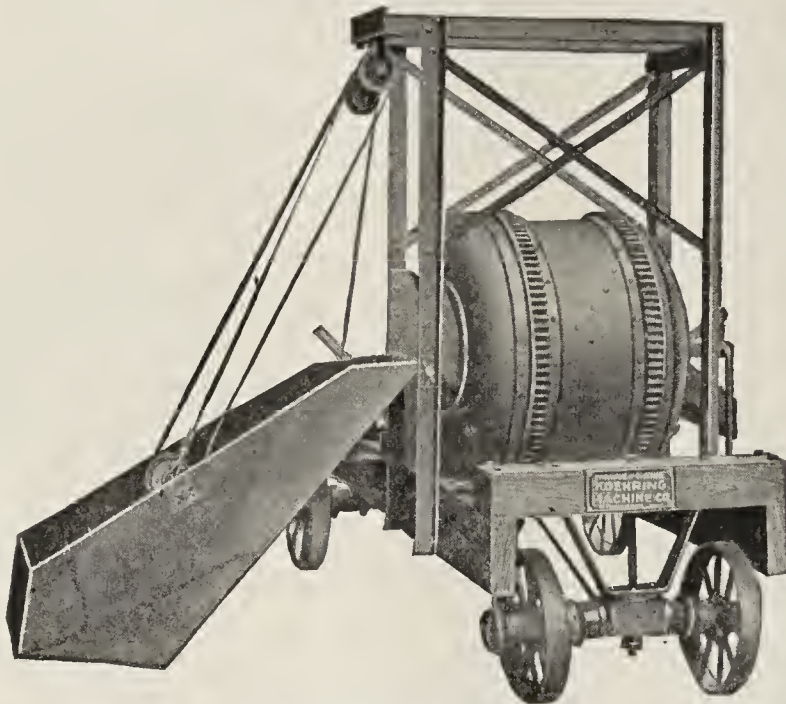
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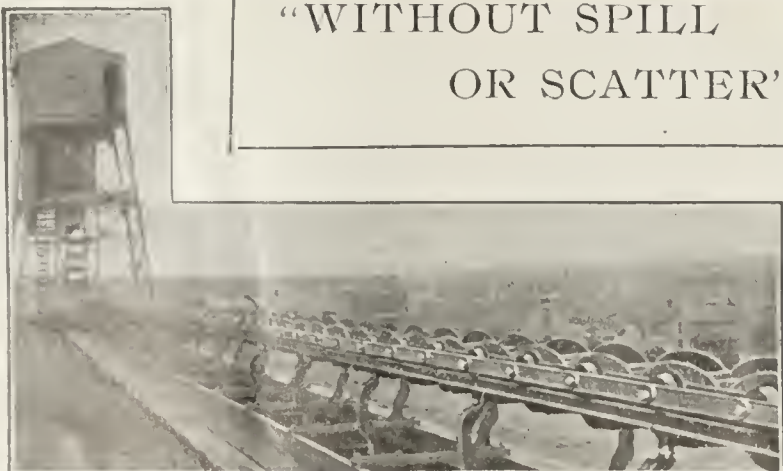
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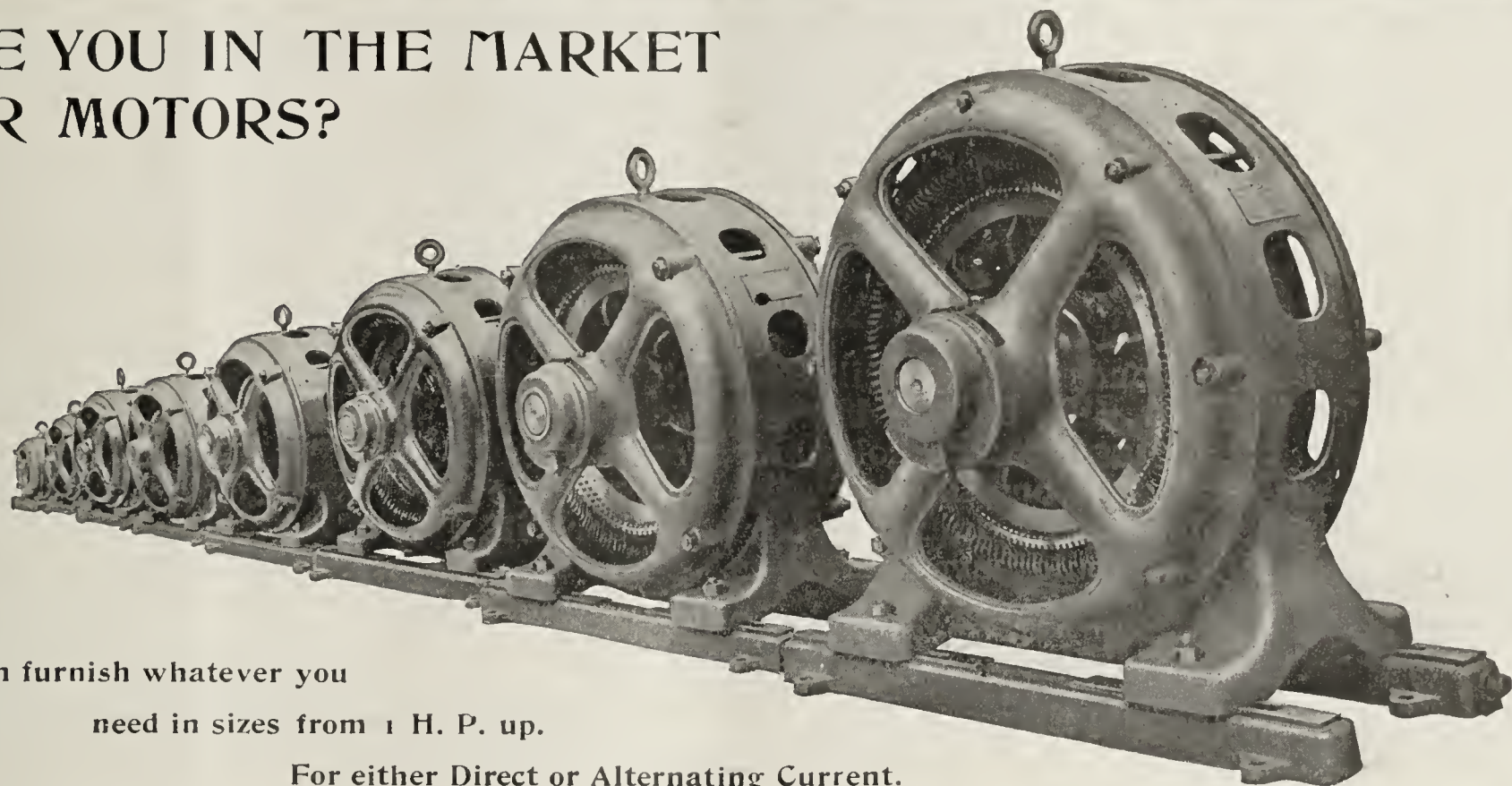
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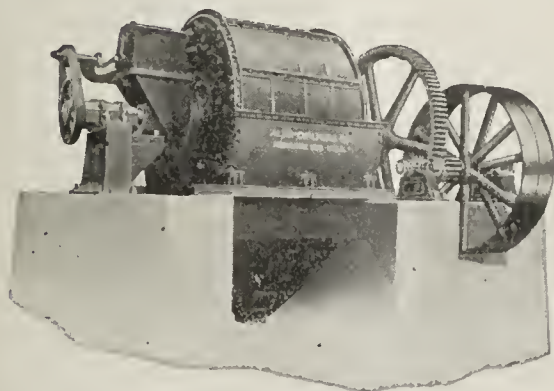
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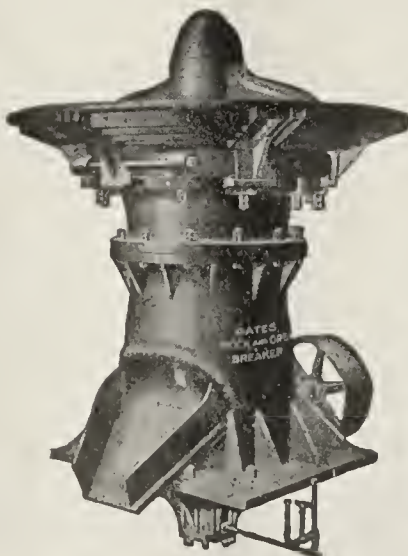
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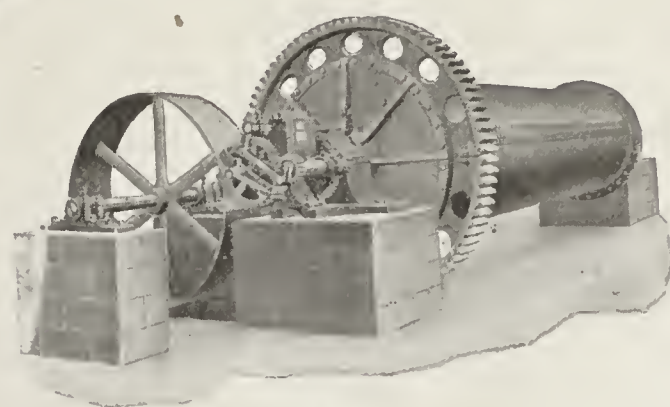
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You claim a capacity of 1,500 pounds for it, and the first thing I did with it was to set a corner stone that weighed 2,100 pounds and it handled it nicely.

Very respectfully,
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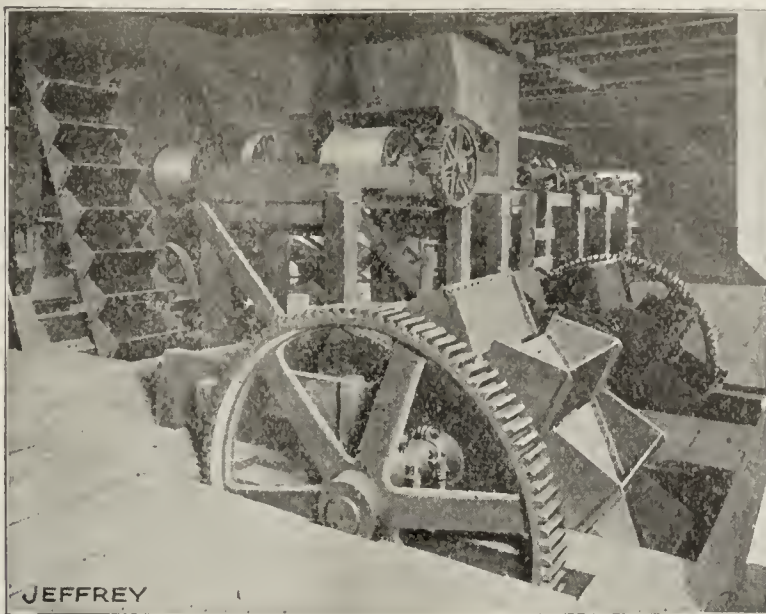
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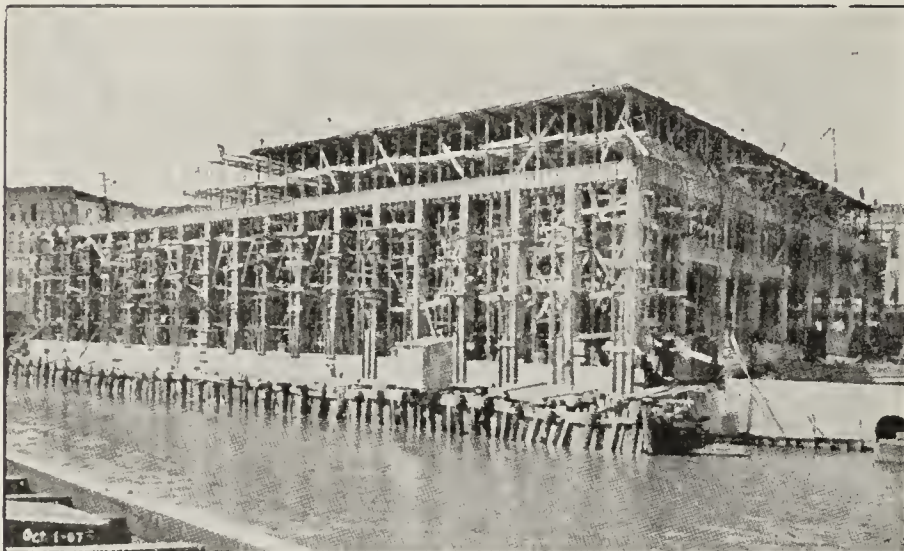
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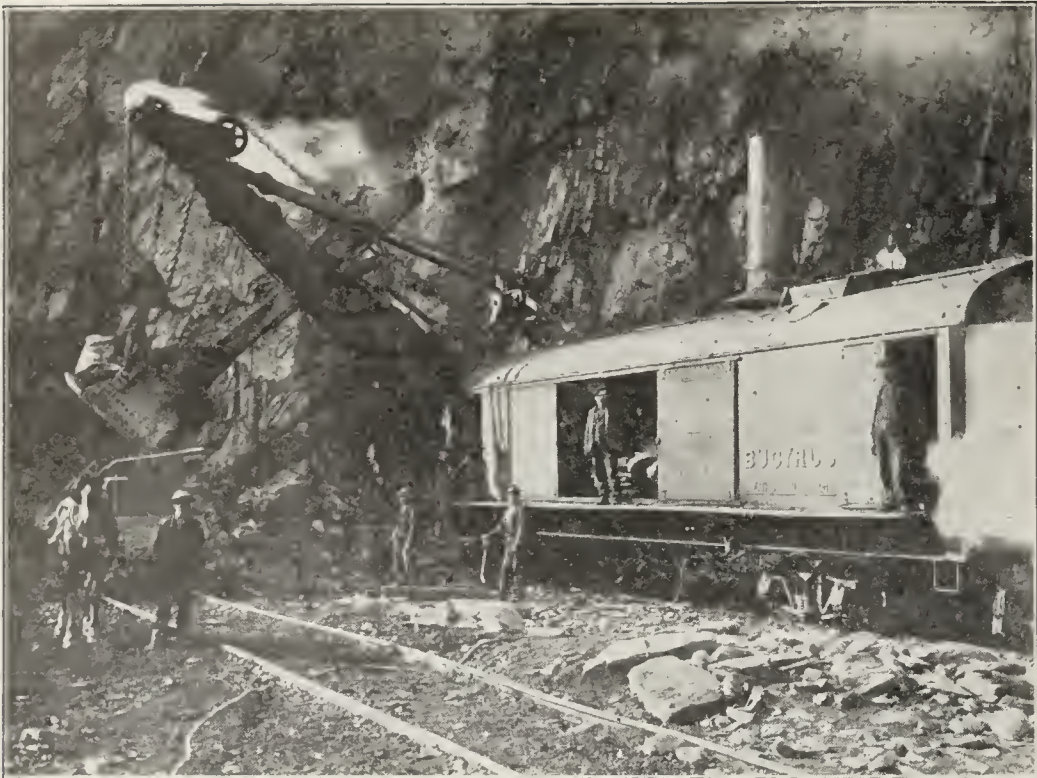
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ENGINEERING NEWS



Fig. 1.—Spirally Reinforced Hollow Concrete Poles for Electric Power Transmission, Showing Method of Manufacture.

See Page 206.

CEMENT AND ENGINEERING NEWS

(PUBLISHED MONTHLY)

WILLIAM SEAFERT, Editor and Publisher

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JOHN F. WALDRON, Advertising Manager

CHICAGO, AUG. 1908.

CORRESPONDENCE.

We solicit correspondence on all matters of general interest to the cement trade in all its branches. Engineering notes, public improvements, and facts and opinions drawn from practical experiments will be welcome.

CEMENT STREET PAVING.

The use of cement finish street paving is gradually being introduced in cities and towns in this country, displacing asphalt, brick and stone, which are at present the favorite materials for this class of work. The first cement finish cement paving laid in this country, was at Bellefontaine, Logan Co., Ohio, over 12 years ago. Some time later, Mobile, Ala., laid a stretch around one of its small parks.

The city of Grenoble, France, with a population of over 50,000, has paved all of its streets with Portland cement for years, and it is giving the best satisfaction. Cement sewer and water pipe being used in Grenoble. The objection to cement street pavement is that the street cannot be used for a month after being laid. This is overcome in Grenoble by covering the entire street with plank one week after the street is finished, when traffic is resumed as usual. In three months the plank covering is removed. Gary, Indiana, the new U. S. Steel Corporation town, has paved its streets with Portland cement concrete. Under the R. S. Blome Patents of Chicago the Blome company has laid concrete street pavements in many parts of the country, several Chicago streets are paved with cement finish, all giving the best satisfaction. Richmond, Ind., has several of its streets paved with cement. Other towns in the west are sending their engineers to Richmond to investigate, with the view of placing cement finished streets in their own towns, people

have not yet been educated to the use of cement street paving.

Berlin, Germany has tried cement paving in its business section. The only trouble was that the pavement was so good and strong, that it could only be removed with the greatest difficulty to get at the gas, water and electric light mains, beneath the street. Easton, Pa., is to lay an experimental block, having been educated thereto by the good wearing properties of cement finished bridge floors. We believe there is a great future for cement finish street paving in this country and that it will rival in extent the popular cement sidewalk, which is being laid in every hamlet in the country.

QUALITY OF WATER IN LEHIGH RIVER.

Samples of the river water have been collected from day to day at South Bethlehem and shipped to the Survey's laboratory at Washington, D. C., where chemists have submitted it to critical analysis. These studies are still unfinished, but many conclusions regarding the stream have been reached. It is shown, for example, that each year about 270,000 tons of dissolved minerals are carried past South Bethlehem. Of this quantity 10.2 per cent is silica, the chief constituent of sand and of most rocks; more than 15 per cent is calcium, washed into the stream as sulphate and carbonate of lime; nearly 6 per cent is magnesium; nearly 8 per cent is sodium, one of the constituents of common salt; only 1 per cent is iron. The grand total of the minerals borne by the stream is made up of the metals named, carried in combination as sulphates, carbonates, chlorides, and nitrates. The sulphate compounds are the chief constituents, amounting to about 116,000 tons a year; the carbonates are next in rank, aggregating about 86,000 tons a year.

These quantities seem great, but it must be remembered that the materials are washed into the stream from a large area. For each acre of ground that the river drains it bears away only 1 3-4 pounds of minerals daily.

The great quantity of sulphate compounds indicates a large amount of drainage from coal mines, and this has a very undesirable effect on the water for most industrial uses, making it harder and much more likely to form scale in boilers and less suitable for the textile industries and for general domestic purposes. Nevertheless it is still soft as compared with waters of the Middle West, and, after filtration to

remove the excessive turbidity at flood stages of the river, it can be used successfully in nearly all industries that require large volumes of water.

CARBONITE.

When the use of "safety" explosives was first agitated in the United States, the E. I. du Pont de Nemours Powder Company was among the first to place an explosive of this class on the market.

In following up the usual progressive policy, always pursued by this Company, work was continued to see if it was not possible to manufacture an explosive whose coal getting properties and safety features were superior to the first. After considerable time spent in research and experimental work, a "safety" explosive called Carbonite was perfected and placed on the market, about the first of the current year.

This Carbonite met with wonderful success right from the start. At first only one kind was sold. This is known as Carbonite No. 2 and has shown itself to be particularly adapted for making lump coal. This explosive has become a great favorite in mines where a maximum of large coal is desired.

The Du Pont Company still pursued the work in order to obtain a powder that would be more satisfactory to the coke manufacturers, who desire their coal broken up fine. The result of this was the Carbonite No. 1, which is somewhat denser and considerably quicker in its action than the Carbonite No. 2. This has also met with the greatest approval from the mines of the Connelsville Coke District.

To still further lighten the troubles of the miners, the du Pont Company continued their experimental work until a Carbonite was perfected that would stand a temperature of 35 degrees Fahrenheit, without freezing. This explosive when frozen, thaws very quickly. The low freezing Carbonite is manufactured in both the quick and slow kinds.

Carbonite has met with the best success in practically all the mines in which it has been introduced. It not only has done its work well, but has proven itself to be the safest explosive for use in gaseous and dusty mines that has ever been manufactured. In short, the placing of Carbonite on the market marks a distinct advance in the use of "safety" explosives in the United States.

DESCRIPTION OF THE GRELLET COLLINS BUILDING.

This article describes what the author believes to be the best built manufacturing building in the city of Philadelphia. The building is an example of the standard of excellence maintained by our organization.

The architectural design, the general layout of the building, and the superintendence for the owner, was executed by Mr. William S. Vaux, Architect, Bailey Building, Philadelphia.

The structural designing and erection of the reinforced concrete work, the erection of the brickwork,

some of the upper floors those of their customers who might wish to lease very strong floors of large area built to carry the heaviest type of lithograph presses.

This modern fireproof building, located in the heart of the business section, and facing on four streets, has approximately 70 per cent glass on all sides, and an exceptional supply of light, and perfect ventilation. One main entrance in centre of building on Sixth Street, connecting with passenger elevator, and steel staircases to all floors. One side entrance west end of Cherry Street front, and one side entrance west end of Quarry Street front, opening

Story heights: Basement, 11 feet clear.

First floor, 15 feet clear.

All other floors, 11 feet, 6 inches clear.

Ceilings: Flat, no beams or girders to interfere with distribution of light.

Walls, posts and ceilings in light tint.

The vexatious delays incident to the transfer of merchandise from truck to building, or the reverse, on a public street, are largely eliminated by a private driveway, 18 feet wide, open at both ends, on which faces a shipping platform with 1,600 square feet of surface, protected with wet weather metal hood, and supplied with two fast-running freight elevators connecting with all floors.

Steam heat, electric light and power, modern plumbing, steel staircases in fireproof towers, and improved sprinkler system contribute to both comfort and safety.

The building has been pronounced strictly "first-class" by the inspectors, and it, together with its contents, is, therefore, entitled to the lowest insurance rates.



Grellet Collins Bldg., Philadelphia, Pa.

finished woodwork and execution of the general contract for the entire building, was contracted for and executed by John G. Brown, Specialist in Reinforced Concrete.

The patented "Mushroom System" of reinforced concrete invented by Mr. C. A. P. Turner, Minneapolis, Minn., used in the building and herein described, is handled by John G. Brown.

The object of the building is to provide for the Dill & Collins Co., makers of high-grade coated lithograph papers; a large and thoroughly fireproof warehouse, adequate for their rapidly increasing business and to accommodate on

into fire towers having steel staircases, connecting with all floors.

Hard-burned red brick, with ornamental terra-cotta trimmings and battlement cornice.

Mushroom System of Reinforced Concrete; metal frames and sash; wired glass and metal-covered doors. The first to sixth floors, inclusive, designed to carry a live load of three hundred pounds, and the seventh and eighth floors one hundred and fifty pounds per square foot of floor area.

Floors covered with tongued and grooved hard white maple on wooden sleepers imbedded in concrete.

DESCRIPTION OF THE REINFORCED CONCRETE DESIGN.

The original design of the building called for structural steel columns and reinforced concrete floors of the ordinary reinforced concrete Beam and Girder System as shown in Figure No. 1.

The patented "Mushroom System," Fig. 2, of Reinforced Concrete, controlled by John G. Brown, was adopted because it was a decided improvement over the Beam and Girder System for the following reasons:

1. It would give a perfectly flat ceiling without beams or girders, and owing to the flat, level ceiling, the daylight from the windows would travel a greater distance. (Figs. 3, 4.)

2. The total thickness through the floor in the Mushroom System would be seventeen inches less than in the Beam and Girder System and thereby give seventeen inches more head room and clearance in the same story height.

3. Owing to the absence of projecting beams and girders shafting could be placed on the ceiling to line in any direction, simplifying shafting problems. Sprinkler piping and sprinkler heads could be better and more economically spaced than in the Beam and Girder System as in the beam and girder system sometimes sprinkler heads have to be placed on each side of

beams due to the interference of the projecting beam with the distribution of the water.

4. The cost of plastering or painting the ceilings, if desired, would be 65 per cent. less if the Mushroom System was used, due to the flat ceiling, whereas in the Beam and Girder type the sides of the beams and girders are equivalent to 65 per cent. of the flat ceiling surface.

5. If it should be necessary to divide up any portion of the floors into separate rooms, partitions (owing to the absence of beams and girders) could be placed in any position, making exactly the size room desired, thereby economizing space.

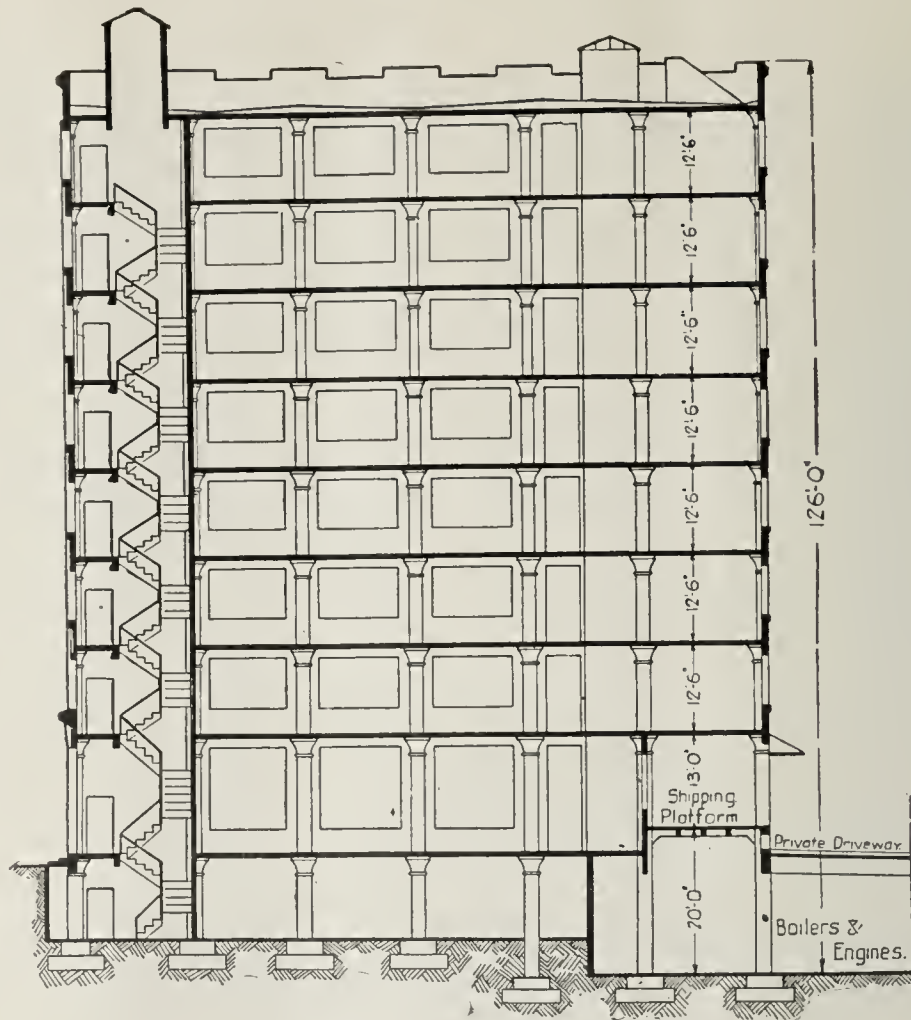
6. The reinforcing rods of the Mushroom System cross over and beyond the column centres, making a lap of four to five feet, tying the construction in a far more thorough manner than in any other system.

7. As the building was designed for heavy paper storage, heavy lithograph and printing presses, a construction was desired that would be rigid and free from vibration. The "Mushroom System" was superior.

**THE OFFICIAL TESTING OF THE
FLOORS OF THE GRELLET COL-
LINS BLDG., MUSHROOM SYS-
TEM BY THE CITY OF
PHILADELPHIA.**

The Bureau of Building Inspection required that portions of the floors of the building (said portions to be selected by them) be tested with a gradually applied load of twice the actual working load the floors were intended to carry, and that while the floors were being tested the deflection of the floors due to bending were to be carefully measured, as upon the amount of the deflection in proportion to the amount of the load, the Building Department could judge the safety of the floor.

To obtain the results carefully and accurately, five iron rods were hung at various points from the underside of the first floor, and upon these rods targets were secured. The floor was then cleared, the targets carefully adjusted by means of an engineer's level, and the loading begun. The loading was accomplished by placing boxes loaded with heavy coated enameled paper (the weight of boxes previously determined), over the entire area to be tested; when one layer of boxes was finished, the deflection of the floor was noted on each target, then another tier placed on top and the deflection noted, following out this plan until the loading was finished.



Section of Building

To load the first floor required two and a half days, and the load was allowed to remain over night. The floor was then gradually unloaded and the recovery of the floor back toward its original position was carefully noted upon the removal of each layer of boxes.

In testing the first floor, which was designed for 300 pounds to the square foot, the deflection ($\frac{5}{32}$ of an inch) in proportion to the test load ($6\frac{3}{4}$ tons or 633 pounds to each square foot), considering the thinness of the floor slab ($7\frac{3}{4}$ inches) was considered very remarkable, and an evidence the floors could

carry considerable more than they were intended to carry.

The contract for the building allowed a deflection of $\frac{12}{32}$ of an inch, which was nearly 3 times more than the deflection by the test.

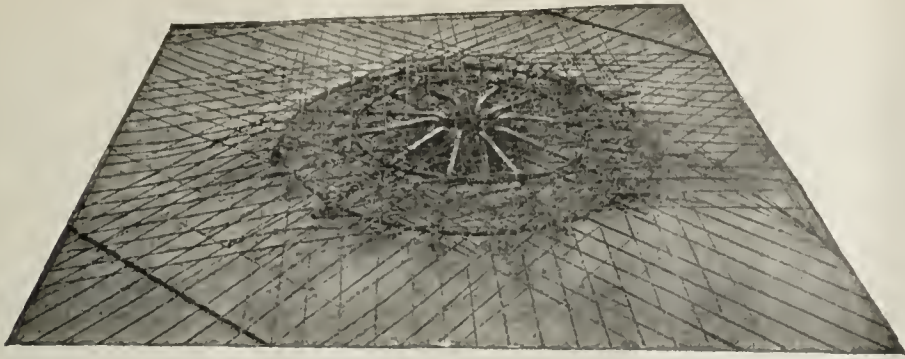
The results of the test on the first floor was so remarkable that it was decided to test the seventh floor. This floor was designed to carry 150 pounds to the square foot, and was tested to 300 pounds to the square foot (to read the deflections, nine rods with targets were used), the deflection was only $\frac{3}{32}$ of an inch. As a matter of general interest the seventh floor was tested to two and



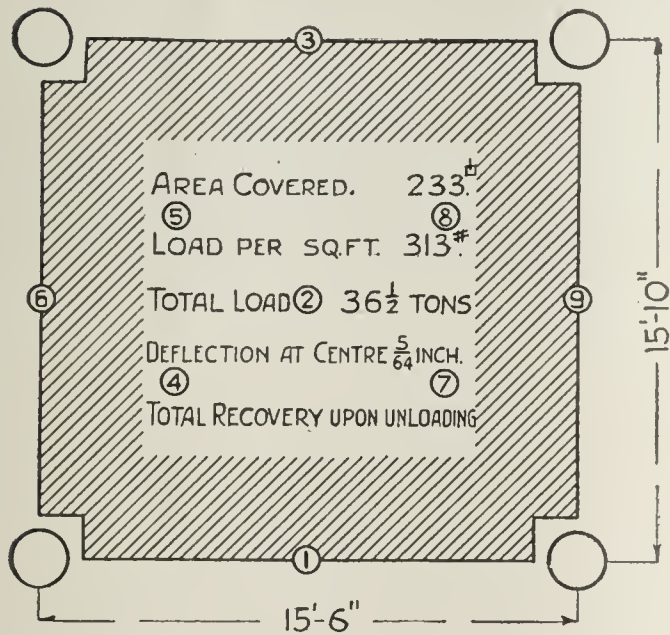
Interior Grellet Collins Building.

"Mushroom System," Distance From Camera to Window, 110 Feet.

Note the Flat Ceiling, no Exposed Beams and Girders; see the Wonderful Distribution of Light.



Top of Reinforcement over Mushroom head.

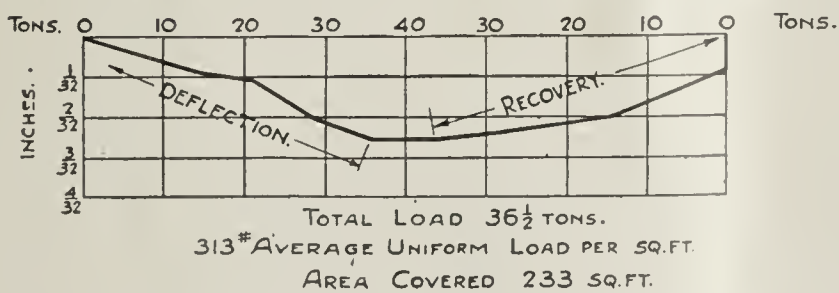


FIGURES ENCLOSED THUS ⑤ REPRESENT POSITION OF TARGETS.

TEST OF SEVENTH FLOOR CONSTRUCTION. GRELLET COLLINS BUILDING.

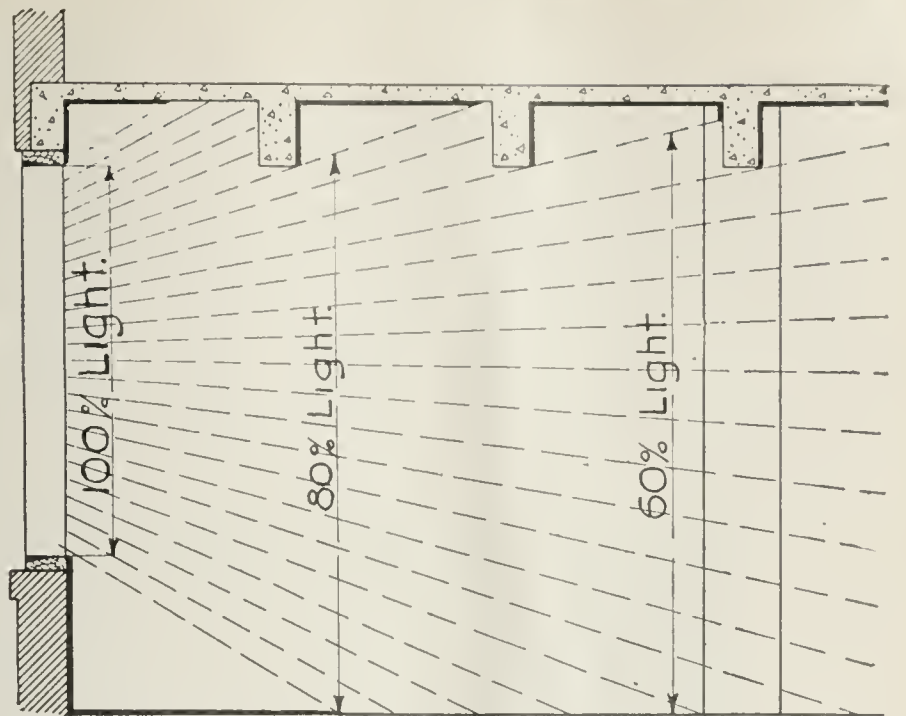
JOHN G. BROWN, CONTRACTOR.
 WITHERSPOON BLD'G. PHILADA., PA.
 5/11/08.

PLOT SHOWING DEFLECTION FOR EACH INCREMENT OF 7½ TONS LOADING.
 PLOT SHOWING RECOVERY ON REMOVAL OF EACH 7½ TONS LOAD.

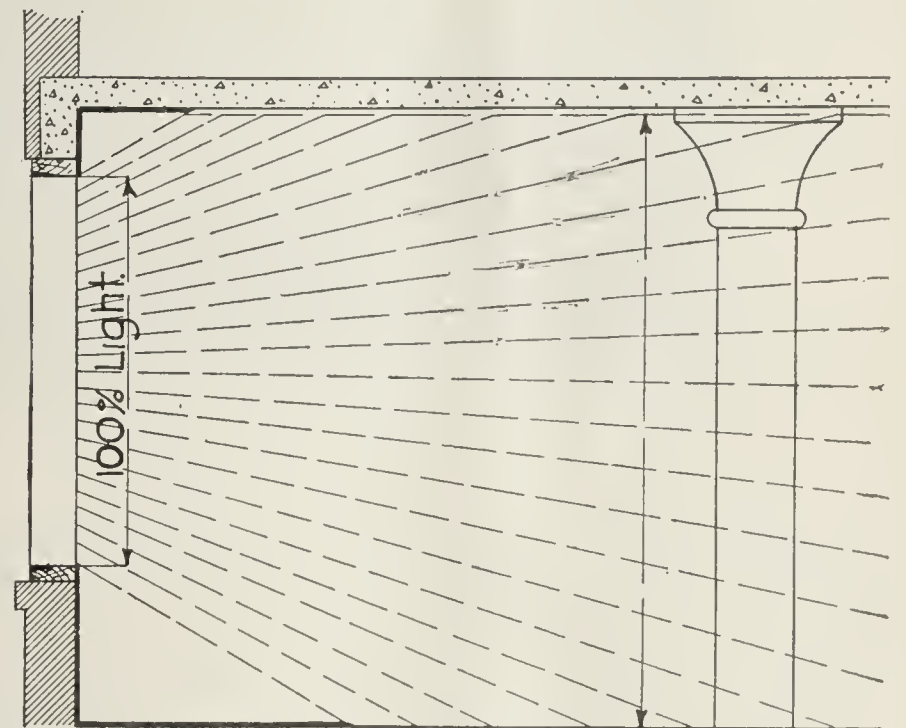


TEST OF SEVENTH FLOOR CONSTRUCTION OF GRELLET COLLINS BUILDING.

JOHN G. BROWN, CONTRACTOR.
 WITHERSPOON BLD'G. PHILADA., PA.
 5/11/08.

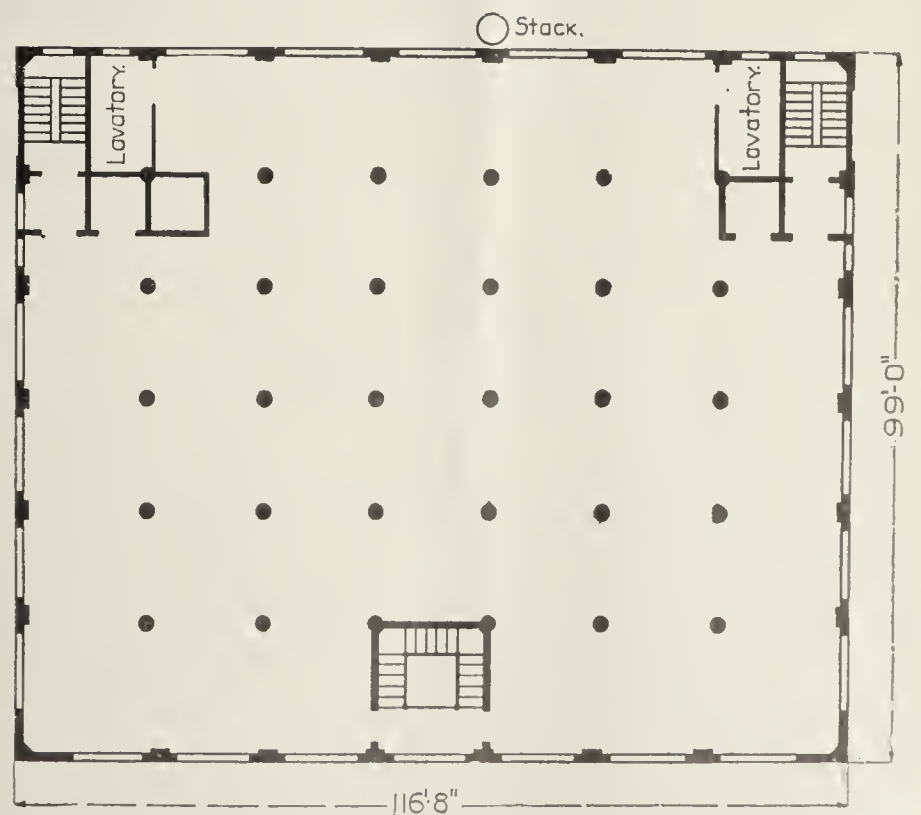


Reinforced Concrete Beam and Girder System. Beams and Girders Block Light Rays.



Mushroom System.

Flat Ceiling, Nothing to Block Light Rays. The Light Travels Along Ceiling, Lighting Interior to Greatest Distance.



Typical Floor Plan.

one-half times the designed load, with a very small increase in deflection.

In each test conducted the results were so pleasing to the Building Department that it was officially approved for use in the first-class buildings of Philadelphia.

The testing for the city was under the direction of Mr. George Warner, Concrete Engineer, Bureau of Building Inspection, City of

of Wilson, Harris & Richards, Architects and Engineers.

Mr. Chas. M. Mills, Principal Assistant Engineer, Market Street Subway and Elevated R. R.

Mr. Edward F. Cobb, Sales Department, Vulcanite Portland Cement Co., which company supplied the cement for the reinforced concrete work.

Mr. Richard Erskine, Architect, and Norman Hume, Inspector of Construction, representing Mr.

increase the durability of dams, reinforced concrete has come into very extensive use. It is now generally recognized that though first cost is somewhat higher the concrete steel dam is by far the cheaper in the long run. The first cost has, however, been materially reduced by constructions of the skeleton type, which usually require the least possible amount of material and are cheaper than any other form of masonry dam.

The dam recently built for the Little Androscoggin Power Co., Auburn, Maine, by the Aberthaw Construction Co., Boston, Mass., is of this type, being entirely of reinforced concrete. The crest and deck are supported by buttresses spaced 12 feet on centres, varying in thickness from 18 inches at the base to 12 inches at the top, the highest being about 40 feet. Horizontal 12 by 16 inch beam members, 10 feet on centres, provide stiffening for the buttresses. The crest is about 2 feet thick at the middle. The deck varies in thickness from 1 foot at the crest to 2 feet at the base. The dam in question is 225 feet wide and of an average depth of about 35 feet. The rock bottom was blasted out in places to form a good foothold for the concrete foundation. It will be noticed that the dam is entirely open on the down stream side. Reinforcement consists principally of cold twisted bars of high tensile strength and elastic limit. A flash board tops the crest, held in place against the water pressure by upright steel rods set into iron pipe imbedded in the concrete. These rods may be removed for straightening whenever necessary.

The work was carried well into the fall and to prevent freezing of the concrete, salt was used in the mixing water. As soon as the waste ways were constructed work on the dam was pushed in both directions. Two adjacent buttresses were built up at the same time. The forms were raised to a height of about 5 feet, and a platform or box placed on beams resting upon them. The concrete was mixed on shore and fed to this box by means of a large bucket on an overhead trolley connecting both shores. As soon as two buttresses had been built to the proper height the box would be removed by means of the trolley to the next pair of forms.

An interesting feature of this dam is an enclosed foot passage which extends under the crest from the easterly shore to spillways, access to the top of which may be had by an iron ladder.



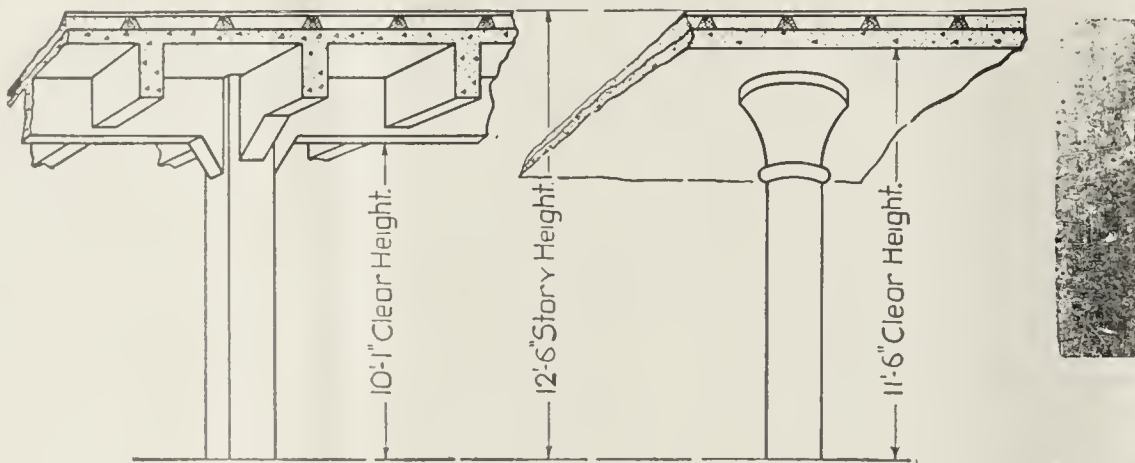
Laying Out the Reinforcement for Mushroom System.

Philadelphia. The deflections read by Mr. James Haldeman, Assistant Engineer in charge of Lines and Grades (east half), Section Six, Market Street Subway.

The test of the first floor was witnessed by Mr. Edwin Clark, Chief of Bureau of Building Inspection, City of Philadelphia.

Grellet Collins, owner of the Building, Bailey Building.

The plasterers, cement workers, bricklayers and hod carriers' unions at San Francisco, are having a four-cornered dispute over certain work which each union claims as



Mr. Manton Hibbs, Structural Engineer, Bureau of Building Inspection, City of Philadelphia.

Mr. Geo. S. Webster, Chief of Bureau of Surveys, of Philadelphia.

Mr. Geo. E. Datesman, Principal Asst. Engineer, Bureau of Surveys.

Mr. Henry H. Quimby, Asst. Engineer Bureau of Highways, Bridge Engineer, City of Philadelphia.

Mr. Howard Richards, Member

its own. In the mean time no work can be done until the matter is settled. The grievance committee of the Federation is to take some action that will dispose of these internal union troubles for all time.

A REINFORCED CONCRETE DAM.

In order to reduce the cost of maintenance and at the same time



Fig. 1. Constructing a Reinforced concrete Dam.

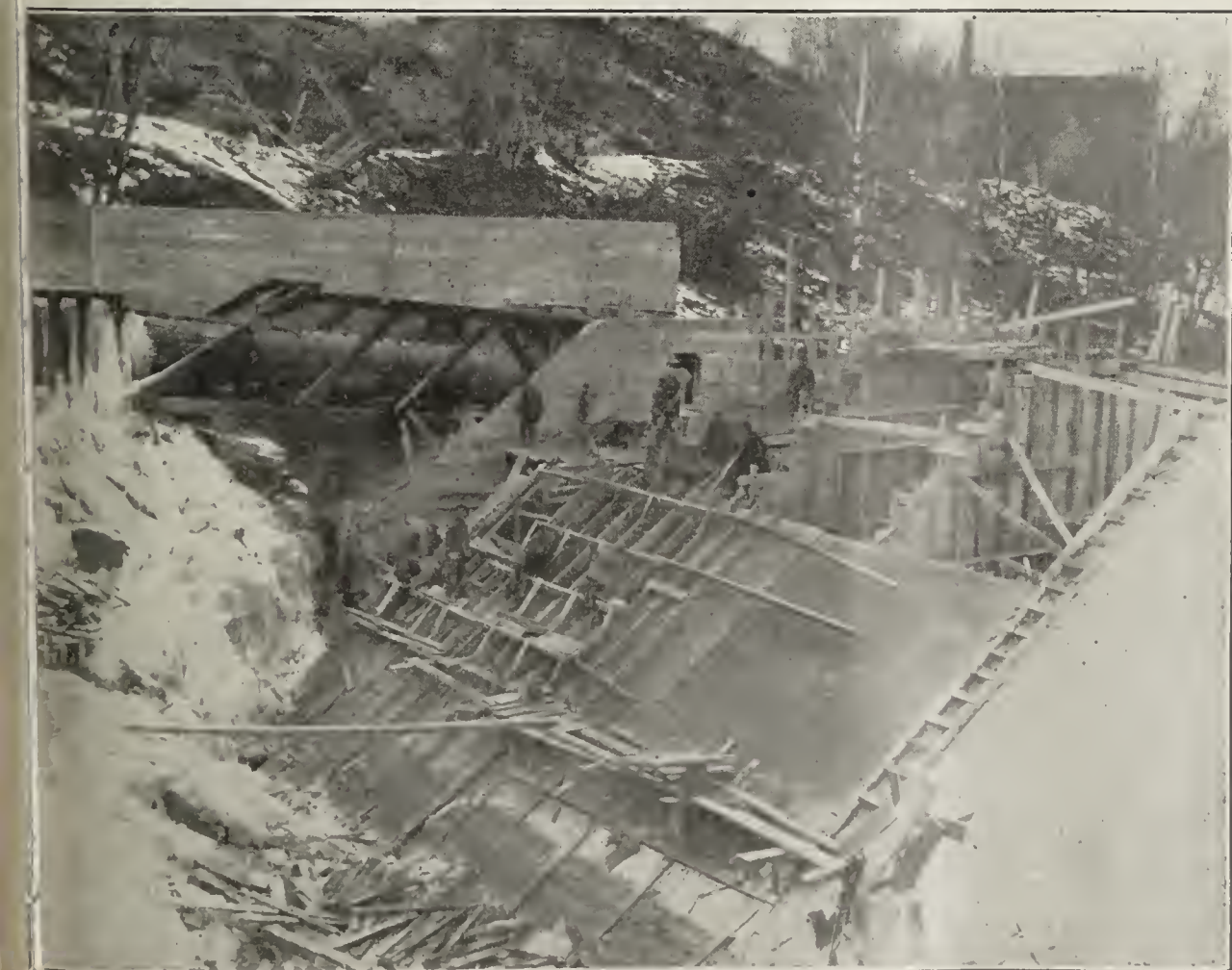


Fig. 2. Constructing a Reinforced Concrete Dam.

FUEL TESTING PLANT IN ST. LOUIS.

*A forthcoming bulletin of the United States Geological Survey, will contain an exhaustive report of the tests conducted at the Fuel Testing Plant in St. Louis, Mo., and Norfolk, Va., on the gas producer. An interesting feature of the report will be the behavior of a certain bone coal from West Virginia in the producer. This fuel was considered of little or no value for steam boiler work, yet showed considerable usefulness in the gas producer, developing at the engine a brake horse-power per hour for 1.65 lbs. of coal.

This coal was delivered on the producer platform in lump form up to 8 or 10 inches in size. The coal crusher not being available, at the time, necessitated breaking the large lumps with a hammer. The character of the fuel was rather peculiar; some of the lumps consisted almost entirely of what appeared to be a high-grade bituminous coal, others seemed to be nothing more or less than rock, heavy, hard, and when hit in the dark with a hammer numerous sparks could be readily seen. And again there were many lumps of this rock-like substance to which adhered much good coal. In the producer all of these lumps when not too large would burn entirely through. The fuel had no tendency to clinker or coke and worked exceedingly well, needing scarcely any poking. It contained a very high percentage of ash, about 45 per cent, thus causing the ash bed to increase in thickness very rapidly, and throughout the test this fact was not properly appreciated; consequently much of the time during the test the ash bed was too high for best results. The fact that the coal had to be broken by hand and that it was unusually hard and rock-like, had a tendency to allow lumps of coal much too large to be charged into the producer. These large lumps, very high in ash, did not burn entirely through; as soon as the burning was well started, a layer of ash formed around the lump interfering with the combustion of the remaining portion and before it had time to turn it had passed out with the ashes unconsumed. Because of the general appearance of the coal, but little was expected of it, and the test was started with only partial load. After several hours' run, however, the results warranted full load on

*Published by permission of the Director of the United States Geological Survey.

the engine. After thirty-nine hours of full load the accumulation of ash in the producer caused a little trouble; the gas went down in heat value, and it was necessary to reduce the load to about 9 per cent of full load. After much grinding down of the ash bed and special care in breaking up the lumpy coal, the gas began to increase in heat value, and at the end of the test the producer was again in shape to maintain full load at the engine. The calculations for the test are based on 50 hours, taken from the time full load was carried by the engine, and for this period the gas averaged 144 B. T. U. per cubic foot, with an average load of 97 per cent of full load.

The following is the result of the test on the West Virginia bone coal:

Proximate analysis of the coal:	
Moisture	0.47
Volatile Matter	8.83
Fixed Carbon	46.96
Ash	43.74
	100.00
Composition of gas by volume:	
Carbon Dioxide (CO ₂)	9.7
Carbon Monoxide (CO)	19.5
Hydrogen (H ₂)	16.6
Methane (CH ₄)	1.6
Nitrogen (N ₂)	52.6
	100.00
Duration of test—hours	50
Coal consumed in producer, as fired, lbs. per hour	378
B. t. u. of coal as fired	8,566
Standard gas per lb. of coal consumed in producer cu. ft.	44.1
Efficiency of conversion and cleaning gas.	74.1
*B. H. P. developed at engine.	228.8
Coal per B. H. P. hr. developed at engine, lbs.	1.65

EVERLASTING T-ANCHOR CEMENT FENCE POSTS.

Herewith we present two views of the Everlasting T-Anchor Cement Fence Post invented by Libhart and Edwards, of Troupe, Texas. Fig. 1 shows the general appearance of the post with the earth cut away showing the "T" anchor and is a fair illustration of the method of attaching net and barbed wire. Fig. 2 shows a "re-inforcing arrangement" to be imbedded in the cement at the time the post is molded if extra strength is desired at a corner; or when it is desired to insert the wood blocks B, B, B for posts upon which wood-

*Based on an assumed efficiency of 85 per cent for generation and belt.

en railings are to be nailed for pickets. One strand of this re-inforcing arrangement can be used, or two, or three, and as many blocks B, B, B as you desire railings in your picket fence. In Fig. 1, B, B (enclosed in dotted squares) represent two blocks imbedded to which railings may be nailed, and as these blocks, which are beveled as appears in Fig. 2, are imbedded with the nailing surface just a little lower than the surface of the mold, they are covered with a thin coat

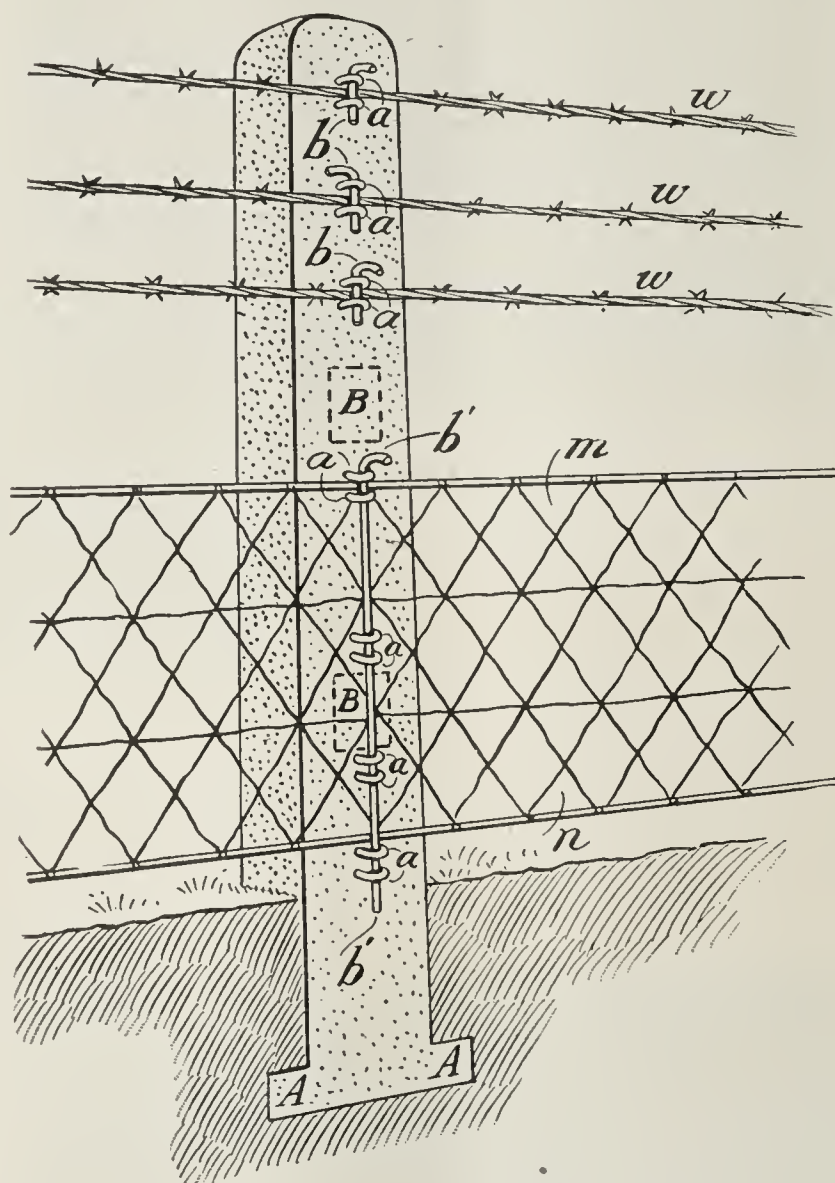


Figure 1. T. Anchor Cement Fence Post, Libhart & Edwards, Patentees, Troupe, Texas.

of cement not too thick to permit of the penetration of the nails from the railings and yet thick enough thoroughly to protect the blocks from the weather. The exact location of these blocks (hidden from view as they are) can always be shown by any kind of a mark or score made upon the surface of the post before the cement dries, yet this is not necessary as they can always be located by measuring the required distance from the top of post after it is set up in the ground.

The primary advantages of this post are its cheapness, durability and the fact that it can be used anywhere a wood post can be used.

These posts can be made in the sizes and lengths required by the average fence at from 6 to 12 cents according as cement rules high or low in price. For corners, gates, hitching posts or in cases requiring the re-inforcing wire or blocks or for poultry yards or enclosures requiring long posts the cost of the post runs from 9 to 18 cents apiece.

There is no limit to the life of this post. The weather and climate have no action on the post except to make it harder and more



Figure 2. Everlasting Tavebor Cement Fence Post, Libhart & Edwards, Patentees.

stone-like. It is no more breakable than stone and even if force enough should be applied to crack, a single strand of the barbed wire within keeps it from coming apart. Once the post is in position it is there for ages, which fact in comparison with the 10 or 15 years of the best wood post would make the "T-Anchor" post cheap at many times its actual cost.

Harry C. Parkes, 1933 Kenmore ave., has been appointed cement tester for the city of Chicago. Mr. Parkes was the only person passing, the Civil Service Examination for the position, salary, \$1500 per year.

GEOLOGICAL MAP OF ILLINOIS.

The State of Illinois Geological Survey, H. Foster Bain, Director, has published a map of the State, showing in colors the location of minerals and soils of the State, which are described in Bulletin six. These two publications will be of great assistance in developing the mineral resources of the State.

The Castalia Portland Cement plant resumes operations on March 6th, for the season.

The construction work on the Union Portland Cement Company's new plant north of Gas City, Kansas, has been delayed on account of delay in securing a switch track to the building site.

WIRELESS TELEGRAPH STATIONS.

There are now 1,550 wireless telegraph stations being devoted to the following uses:



Naval stations, 670; experimental stations, 310; commercial land stations, 195; government light houses, 150; merchant vessel installations, 170; portable military installations, 55; operated under the following systems: Telfunken system, 40 per cent; Marconi, 20 per cent; De Forest, 6 per cent; Fessenden, 3 per cent. All other systems 27 per cent.

TO INTRODUCE A GERMAN PATENT.

Grand Rapids, Ia., Jan. 11.—The Universal Crusher Company, with a capital stock of \$1,000,000, nearly all of which is said to have been subscribed, has been organized here through the efforts of E. A. Velde, who controls the American rights in a stone crushing machine patented by his brother in Germany. This machine, it is said, has only

fourteen parts, big and little, whereas there are more than that many plates alone in the ordinary American crushing machine. It is also claimed for the Velde crusher that it can crush stone to any size desired and that the adjustment of the machine can be made almost instantaneously.

The officers of the new company are as follows: A. H. Newman, president; Henry Rickel, vice-president; I. L. Mitchell secretary-

treasurer; E. A. Velde, manager.

Mr. Velde says that the company will at once begin manufacture of crushers and that the work will be done in local foundries.

FLINT-RIM SPROCKET WHEELS.

The sprocket wheel illustrated by the sectional view has been developed to meet the requirements imposed by the handling of abrasive materials, and by working-conditions too severe for the employment of regular cast-iron wheel. The teeth and rim exposed to the wearing action of chain contact are hardened to a considerable depth, and the surface made smooth and uniform.



Flint-Rim Sprocket Wheel Link-Belt Co.,

This improvement in sprocket wheels not only makes the wheel more durable, but actually prolongs the life of the chain by maintaining the original accuracy of fit between the links and the sprocket teeth. The makers, Link Belt Company, Philadelphia, Chicago, Indianapolis, have coined and copyrighted a trade-name, Flint-Rim, for the new wheels, which are announced as available in most of the active sizes of the "Ewart" type of chains.

IMPORTS OF CEMENT INTO THE UNITED STATES.

WHERE FROM	JUNE				TWELVE MONTHS ENDING JUNE			
	1907		1908		1907		1908	
	Quantity in lbs.	Value in Dollars.	Quantity in lbs.	Value in Dollars.	Quantity in lbs.	Value in Dollars.	Quantity in lbs.	Value in Dollars.
United Kingdom . .	13,709,000	\$49,205			273,587,060	\$901,118	175,756,535	\$653,606
Belgium	24,293,866	76,567	12,586,874	\$42,548	340,008,797	1,054,749	155,854,606	497,660
France	1,518,800	5,320	1,744,705	6,417	16,298,318	60,936	13,148,232	50,296
Germany	7,365,912	22,976	7,834,491	27,843	413,909,830	1,303,281	218,794,855	720,513
All Other Europe . .			4,184	175	20,097,670	57,829	3,895,312	13,640
British North Am. .	33,200	178			3,140,183	22,864	278,290	1,643
Other Countries . .	835,168	4,518	400	4	56,721,746	269,149	5,709,947	30,114
TOTAL	47,755,946	158,764	22,170,654	76,987	1,123,763,604	3,669,926	573,437,777	1,973,472
Domestic Exports of Cement, bbls. . . .	* 93,988	168,471	84,390	124,981	709,455	1,180,415	945,421	1,470,317

There were 15,786,027 lbs. of imported Roman and Portland Cement, etc., in the United States bonded warehouses in June, 1907, valued at \$39,113, against 20,887,978 lbs. in June, 1908, valued at \$80,913.

For twelve months ending in June, 1907, there were 111,015 tons of asphaltum imported in the United States* valued at \$461,698, against 141,482 tons imported in twelve months ending June, 1908, valued at \$566,506.

CONCRETE SEWER CONSTRUCTION.

During the writer's experience as engineer on railway construction, the need of a system by which culverts and small water-ways could be constructed quickly and cheaply became apparent.

After much experience with stone masonry, clay pipe, cast and wrought iron pipe, it was found that concrete was the ideal material for such work, except for the cost of forms and labor and the delays often experienced in completing the grading of the road-bed. This is especially true in electric railway construction and light branch lines of steam railway.

The rapidity and cheapness of construction of some concrete block houses, built about this time, drew the writer's attention to the possibilities of a system of circular or arch sections of cured concrete blocks, properly designed and reinforced to meet the conditions peculiar to railway construction.

As this system could also be applied to sewer construction and from the fact that the most interesting case of test was developed from a sewer section, this example will be given.

This section was egg shaped, as shown in accompanying illustration, the size being 48x72 inches. The mixture used consisted of crushed rock, passing a 1-inch ring, good quality of river sand and Portland cement, proportioned 1:2:4.

Each section consisted of four pieces, one invert, two sides, and one arch or crown block. Each block was 24 inches wide and the crown block 4 inches thick, the thickness of blocks gradually increasing from the center of the crown block to the invert, which at the thickest part was 11 inches. The side blocks lapped or staggered one-half their width or twelve inches on the two adjacent invert blocks.

The bottom of invert block was reinforced with $3\frac{1}{2}$ -in. medium steel rods, spaced 8 inches apart and placed near the flow line of the invert, and bent up the sides of invert block to a point near the top. The middle rod, which was placed in the center of the block, projected about 4 inches and the ends formed loop eyes to attach the reinforced rods of the sides and arch blocks, so that the latter, acting as a beam, would resist the bending movement produced by the thrust of the side blocks.

This section of 48x72 inch sewer



Fig. 1. Loading Test for Concrete Sewer.

was set on roughly level earth, without any special attempt at leveling, thus assuming average conditions of actual practice in the test.

A rough plank platform with 2-inch bearing blocks, spaced about 6 inches apart to transmit the load to the crown block, was placed on top section, as shown in illustration. The load consisted of pig iron and heavy foundry castings, forming a practically solid mass of iron, uniformly distributed over platform. The deflection under progressive loading was obtained by actual measurement referred to a solid base so arranged that the slightest movement could be detected laterally or horizontally. The load was placed from an elevated platform by laborers without much regard to shocks produced by the falling of the iron.

No deflection was observed up to a loading of 10,000 lbs., and the points of the sections remained without a crack. A deflection of $1/32$ inch was observed at a loading of 15,000 lbs.; at 19,500 lbs. the deflection was $1/16$ inch. At 25,050 lbs. a deflection of $3/32$ inch was observed and a fine crack developed on the outside or tension side of both side blocks, running

the full length of side. An additional load caused a crack at the flow line of the invert, the latter failing as a beam the entire length of invert.

It will be noted that the failures occurred at the quadrant points of the curve of the section. The joints remained throughout the entire test free from movement, nor did any cracks develop in the joints of the section. The joints of the section, it will also be noticed, are placed at points of least bending moment, viz.: at points 45 degrees from the axes of the figure.

The advantages claimed for this system are as follows:

1. Absolute mechanical bond of reinforced in all directions monolithic concrete work.

2. The rapidity of construction over any other methods, as it requires no forms, the sections being self-aligning and self-supporting.

3. The trench can be filled at once after grouting is completed.

4. A smooth, true inside surface, giving a greater discharge for a given cross section area than brick sewer and concrete sewer built with forms.

5. The block sections can be inspected before entering the work and if any are defective they can

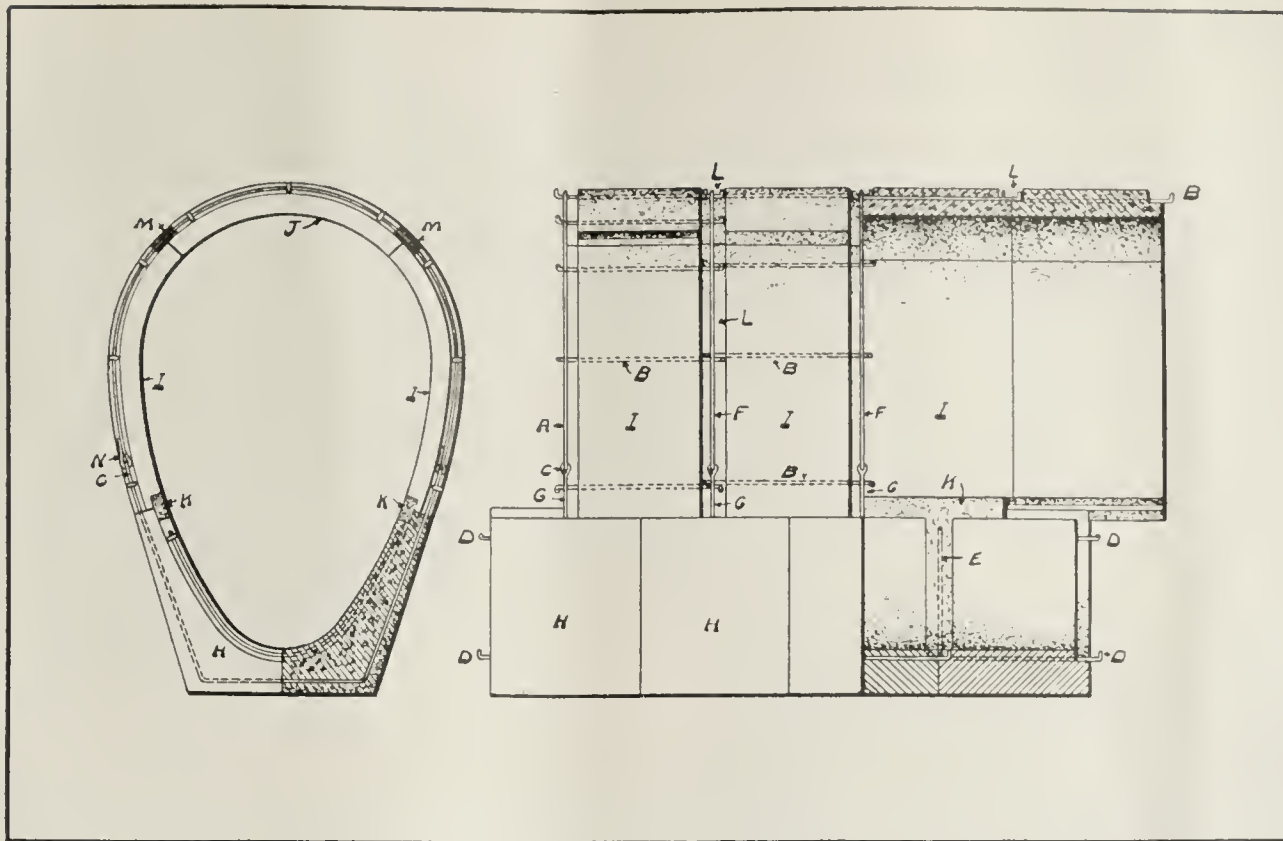


Fig. 2. Concrete Sewer Construction.

be rejected, thus insuring the most reliable work.

6. The quantity and character of the reinforcing can be varied to meet the conditions of loading, grade, soil, etc.

7. The ease with which this construction can be handled in wet springy soils and when running water is encountered in the trench.

It is the belief of the writer that the use of curved concrete for structural uses will come into general use, which will introduce an era of more economical design and more reliable construction. There seems no reason why concrete building members, such as columns and beams, should not be made in the shop, and delivered to the building site, just as structural steel members are. This would allow a test of specimens representing each structure, thus guaranteeing absolute safety.

The Board of Education of Brooklyn, N. Y., has adopted reinforced concrete floors in all halls and corridors in 68 existing school buildings. The wooden floors will be taken up on one story at a time and re-placed with concrete. The school sessions on other floors will continue during the progress of the work.

The Northwestern Bridge Co., of Portland, Oregon, are constructing a 580 foot reinforced concrete bridge at East 28th st., Portland, which is to be completed in 30 days, ending September 1st, at a cost of \$64,000. Three 8 hour shifts are employed on the work.

The Ash Grove Lime & Cement Co., at Chanute, Kansas, turned out its first batch of cement, on July 30th.

The Great Lakes Portland Cement Co., is the new name for the Great Northern Portland Cement Co., under the reorganization the new company has issued a \$500,000 first mortgage on its property, bearing 6 per cent gold to the Detroit Trust Co. G. M. Reed is president, and Harold W. Hanlon secretary of the company.

The Anchor Trust Co., of Wichita, Kan., has commenced the erection of forty cement cottages on the tract known as the Cottage Park addition. Each cottage will cost about \$1,500, or \$60,000 for the cottages.

City Engineer Smith, of Elkhart, Ind., states that fifteen miles of cement walk will be laid during the present season in Elkhart.

The city of Easton, Pa., is to have a block of cement street paving, cement finish surface. The crushed stone and cement will be donated for the work. The cement floor on one of the bridges with cement finished surface, which has been in service for eight years under heavy traffic, has worn so well that citizens of Easton now want a test made for street-paving, hence the experiment on the block mentioned.

The value of reinforced concrete buildings erected in Los Angeles, from December 1st, 1906 to December 1st, 1907, was \$1,523,132.

THE BUILDING MECHANICS' READY REFERENCE.

Cement workers and plasterers edition, by H. G. Richert; 458 pages; 7x4¼ inches; Morocco binding; price \$1.50 net. John Wiley & Sons, New York, Publishers.

This is an eminently practical treatise on the subject of cement construction. It covers all kinds of cement work, with numerous tables, 193 illustrations. The author has had a wide experience as superintendent of construction on U. S. government buildings. It is full of just such data as the cement contractor daily requires in the execution of his work.

The Bonner Portland Cement Co., of Bonner Springs, Wyandotte Co., Kansas, is to be enlarged.

The American Cement Engineering Co., of New York City, is to build a cement plant 5 miles south of Catskill.

J. H. Barton, manager of the Ash Grove Lime & Cement Co., of Chanute, Kansas, was stricken with apoplexy and died on August 4th. The remains were taken to Springfield, Mo., for burial.

The Round Top Cement Plant at Hancock, Md., was offered for sale at Public auction on August 4 by J. Fenton Thomas of Baltimore, receiver of the company. The only bid on the plant was \$1100, by a Hagerstown business man. The plant originally cost over \$30,000.

REINFORCED CONCRETE POLES FOR ELECTRIC POWER TRANSMISSION.

One of the most difficult tasks for engineers in the constructing of lines for the transmitting of electric currents of high voltage, has so far existed in the selection of proper poles for carrying the wires. The wooden poles heretofore used were not strong enough, and had to be frequently replaced which caused continuous trouble and interruption on the lines. Poles of wood therefore had been abandoned for some time, and been replaced by hollow metallic poles. There are likewise serious objections to these owing to

resistance to bending which is the principle property required of poles destined to carry long distance wires. This property of resistance is found in the properly constructed concrete pole. Hollow concrete poles have now taken the place of all other kinds. As shown in Fig. 1, page 195, these are spirally reinforced in such a way that a minimum amount of concrete is required, and the weight is lessened to about 1-5 of the weight of the solid poles. These poles are at the same time elastic, and possess on account of the reinforcing method, a very high resistance to bending. The

thus necessitating a great bending resistance.

Abstract from *Revue des Matériaux de Construction et de Travaux Publics*.

A NEW IDEA IN ROTARY DRYERS. INCORPORATED.

A rotary driver possessing features of considerable novelty have been developed by the Atlas Dryer Co., of Cleveland, O. The fundamental idea of the new dryer, which is the invention of Mr. W. M. Cummer, president of the company, is that of bringing into direct contact with the material to be dried the greatest possible quantity of heated air.

The manner in which the problem has been solved is very clearly shown in the accompanying figure. From the basic idea of drawing the heated gases through a screen and through the material

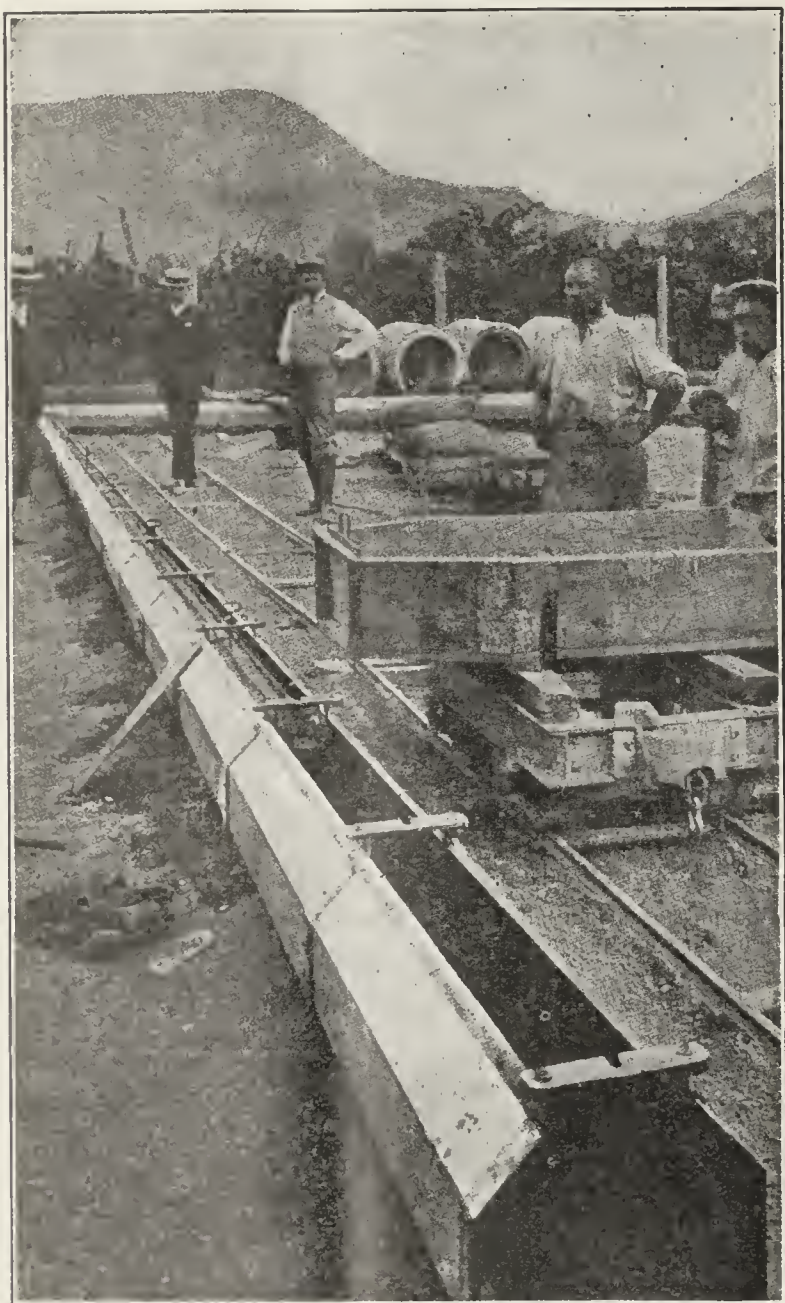


Fig. 2.

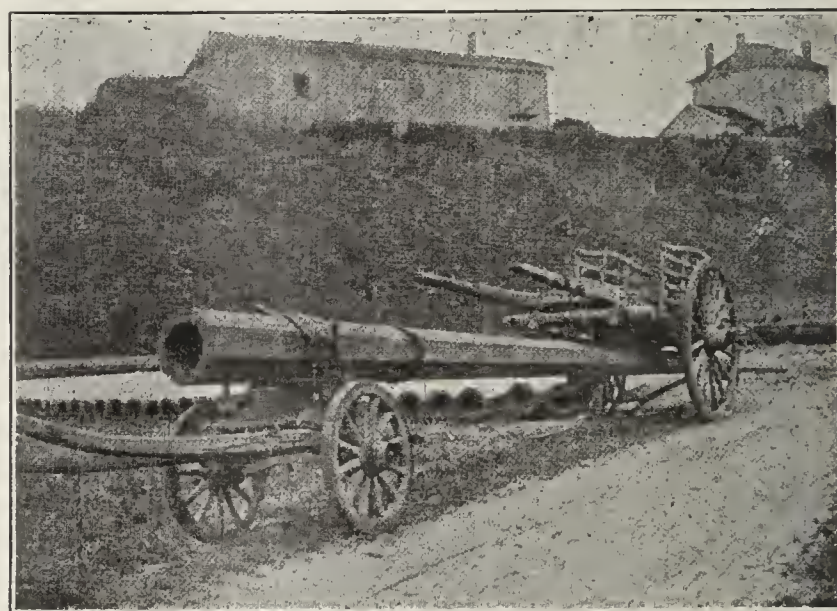


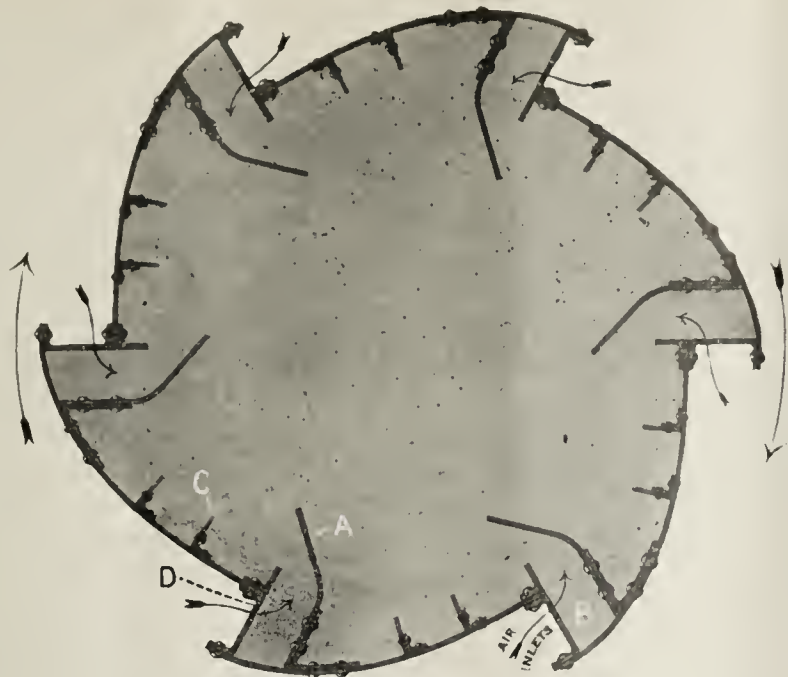
Fig. 3.

their high cost, and to the fact that they rust easily when used in moist and swampy ground; consequently poles had to be found which did not require frequent painting or replacing. Solid concrete poles were tried, but were found to be of little value on account of the heavy weight. Only after engineers succeeded in adapting concrete for this special purpose, did it prove to be a success in the form of a hollow reinforced concrete pole. The main object was to devise a pole which was at the same time as light as possible, and offered a great

main difficulty in constructing these poles consisted in designing molds in which they could be cast, without requiring the use of too many molds. Fig. 2, shows an octagonal mold consisting of many sections, and constructed in such a way that it can be used over and over again. Many poles can therefore be formed in the course of a day by using the same molds. Fig. 3, shows the poles ready for transportation and erection. These poles are often placed hundreds of feet apart and have to carry dozens of heavy wires, imposing a heavy weight on the pole,

to be dried, resting on the screen, was evolved the sectional cylinder, so designed that the hot gases and air can be drawn through the periphery and into direct contact with the material, the latter being kept constantly "cascading" by the vanes or lifting blades as the cylinder rotates in a clockwise direction when viewed from the turnace end. The inclination of the cylinder, of course, keeps the material moving longitudinally.

The cylinder, as will be seen from the cut, consists of six curved sections held together by six channel irons running the entire length of the sections. In the channels are slotted openings for the admission of the heated air and gases. It will be seen that there are six broad, curved lifting blades directly opposite and inside the openings in the channel irons; these perform the dual duty of guarding the air passages, thus



Cross Section of the Atlas Dryer.

preventing the driving material from falling out, and of lifting and cascading the material. The broad blades are assisted in the latter function by the small lifting blades.

A casual consideration of such a cylinder, with peripheral openings of considerable size, is apt to lead to the impression that the material within the cylinder will, in operation, fall through the openings. A study of the figure, either imagining it to rotate or actually rotating it in a clockwise direction, will show how this is impossible. Take the air inlets at the bottom, and right of the cut; they are cut in a surface which is in a radial plane; as it rotates under and to the left, material from the blades already up on the ascending side does not commence to fall into the "pocket" formed between the blade and the channel iron until the radial plane of the web of the channel is well past the vertical and the openings consequently at the upper side of the "pocket." Material from the small lifting blades does not fall into the larger until that plane is almost horizontal, hence none of the material can leave the cylinder.

TO BUILD BIG CEMENT PLANT.

The announcement of the incorporation of the Buckeye Realty & Construction Company, of Sandusky, O., with a capital stock of \$100,000, it is reported means the erection and operation of a new 22,500-barrel Portland cement mill in that vicinity. The exact site is not yet known.

The men back of the project own extensive marl lands near Castalia, adjacent to several railroad tracks. They also have options on other lands, including sites for a plant.

All of the plans have been worked out for a large and modern plant. The company just incorporated will equip the plant, which will then be turned over to a new company, soon to be incorporated, and which will operate the plant.

Portland, Ore., it is reported, is to have a great cement manufacturing plant, to cost \$500,000, and work on its construction will begin within the next sixty days. The thousands of tons of cement that are used in building, irrigation construction and pavements in the Pacific Northwest are brought long distances by rail and ocean transportation. After this year it will be manufactured at a new plant to be built on the Willamette river bank a few miles above Portland. The company is financed by residents of Portland, Utah and farther east. The man at the head of the organization is C. W. Nibley, a practical cement manufacturer, who lives at Salt Lake City.

The White Cliffs Portland Cement Works, located on the Littel River in Sevier County, Arkansas, was advertised to be sold under an order of the U. S. District Court on July 25th, at Texarkana, Tex., there being no bidders, the sale has been postponed. The minimum bid fixed by the court was \$65,000. The plant is owned by Holland & American capitalists and has never paid expenses.

The Southwestern States Portland Cement Company, Dallas, Texas., will equip the power plant with gas producers and gas engines and save from 25 to 40 per cent in fuel, over and ordinary steam-power plant using coal. 250 men are now engaged on this plant

working night and day, the plant is to be finished early in 1909. Chas. E. Layton, Sup. of Construction.

The Meramec Portland Cement Co., of St. Louis, Mo., is installing a large sand and gravel dredging plant on the Meramec River, a similar sand and gravel dredging plant is to be installed on the Mississippi River. The machinery contracts for the cement plant have been awarded.

The Maryland Portland Cement Co., at Security, near Hagerstown, Md., started up on July 24th, with a capacity of 800 barrels per day. The officers of the company are as follows: De Courcy, W. Thorn, Pres.; Loring A. Cover, Vice Pres.; Harry B. Warner, Sales Mgr.; Maj. F. H. Lewis, Consulting Engineer.

A large Portland Cement Plant is to be built at Portland, Oregon by Salt Lake and Portland, Oregon capitalists, with a capital of \$1,200,000. The Salt Lake City capitalists are represented by C. W. Wibley, President of the Union Portland Cement Co., of Utah. The Company has purchased 100 acres of lime stone land at Roseburg, Douglas Co., Oregon, on the line of the Southern Pacific Railway, 123 miles south of Portland. The line work is to be transported to the proposed mill at Portland, and manufactured into cement.

INCORPORATED.

The Great Northern Portland Cement Plant at Marlborough, Mich., has been advertised to be sold at Grand Rapids, Mich., March 3, 1908, under a decree of foreclosure in default of the payment of \$600,000 due the Union Trust Co. of Detroit. John S. Lawrence, master in chancery, will superintend the sale.

Great Lakes Portland Cement Co. Capital \$1,500,000. General office 511 Moffat Building, Detroit, Michigan. Geo. M. Read, Harold W. Hanlon, of Detroit and Harry W. Davis, of Wilmington, Delaware, incorporators.

President Woods, of the Lumbermans Portland Cement Co., announced that work will soon be commenced at Carlyle, Alten Co., Kansas, on the company's plant. Carlyle is near Iola, Kansas.

BOOK NOTICES.

SOMETHING BETTER.

This is a 31 page Pamphlet, 21 illustrations of specially designed machinery for the new 12,000 barrel flour mill of the Hecker-Jones-Jewett Milling Company of New York City, which is said to be the most modern milling plant in this country or abroad, was designed and executed by the best milling engineers and experts in this country. The first cost of this plant was made secondary to the main object in view that of continuous economical operation with long life and minimum repairs. To accomplish this, it was found necessary to discard many standard patterns and designs and redesign details of machinery.

The pamphlet describes the machinery supplied by the H. D. Coldwell & Sons Company of Chicago, and is shown in 21 illustrations, consisting of multiple rope drive of the engineers or English deep groove sheaves, double disc clutches, automatic barrel elevators, special lowering chutes, for barrels, boxes and bogs, galvanized iron bins. The Coldwell Helicoid conveyors being exclusively used throughout the plant. The pamphlet will be valuable to parties interested in modern milling machinery installations.

MEDUSA WATER PROOF COMPOUND.

The Sandusky Portland Cement Co., of Sandusky, Ohio, has published a 20-page pamphlet describing the Madusa waterproof compound, with specific directions for its use, with several pages of testimonials from large and small users of the Madusa compound in various kinds of construction work, varying from the ordinary concrete building block to tanks and cisterns, roofs, wells and tunnel work, in various parts of the country. It can likewise be used as a wash or paint, producing a waterproof surface. It will prevent efflorescence in concrete work. Two per cent mixed in the finishing coat makes cement floors waterproof. Anyone interested in waterproofing concrete should have a copy of this pamphlet, which will be sent by the company on request.

Reinforced Concrete—A Manual of Practice. By Ernest McCullough, M. W. S. Engs. 128 pages; 7½ x 5 in. Cloth, \$1.00. Cement Era Publishing Co., Chicago.

The author has had a wide experience in all forms of concrete

construction and is well qualified to deal with the subject in hand. The book is divided into eight chapters under the following heads:

1. Strength of Beams. 2. Loads on Beams. 3. Columns. 4. Walls, Tanks and Footings. 5. Design and Cost. 6. Forms. 7. The Conduct of Work. 8. Tools. The work contains many useful tables and illustrations, all designed to guide the constructor of reinforced work in securing the most substantial and appropriate design for various kinds of construction. The chapter on forms is alone well worth the price of the book.

PORTLAND CEMENT, SIDEWALK CONSTRUCTION.

By C. W. Boynton, 61 pages 9x6 in. paper cover Universal Portland Cement Co., Publishers, Chicago.

This is a complete treatise on cement sidewalk construction, with 30 illustrations. It describes the various materials used in cement sidewalk construction, tools and forms required.

Methods of work, from placing foundations to the care and protection of finished work, including the construction of plain and reinforced concrete vault cover work over areas. The most common causes of failures in the construction of concrete sidewalks are clearly described and the bad work shown by numerous photographic reproductions taken from actual specimens of careless workmanship, and other defects which this treatise aims to correct.

The booklet is being distributed gratuitously among parties interested in this class of work, by the Universal Portland Cement Co., Chicago.

CEMENT PLANT.

The newly organized Victor Portland Cement Co., which owns three square miles of natural cement rock at Victor, will within a year have in operation a plant costing \$1,500,000 and having a capacity of 3,000 barrels a day. Francis H. D. Banks is president of the company, and F. H. Merrill is secretary. They have offices in the Central Building, Los Angeles.

The Phoenix Cement Co., of Cement, Stevenson County, Washington, has been organized, with F. G. Jordan, president; Welby J. Metcalf, vice-president; W. E. Jordan, secretary, and W. E. Weltzin, treasurer.

CEMENT WORKS IN WEST VIRGINIA.

An extensive plant for the manufacture of Portland cement is to be established near Martinsburg, W. Va.

The company is to be incorporated under the laws of West Virginia with a capital of \$1,000,000, the incorporators being J. W. Ivery, Dillsburg, Pa.; John T. Morris, Orange, N. J.; Philip Herman, Latrobe, Pa.; Charles Wharton, Pittsburg, and B. A. Waltman and Philip Hake, of York, Pa. F. Vernon Aler, of Martinsburg, will give information concerning the enterprise.

The cement plant to be erected will have a capacity of about a thousand barrels of white Portland cement per day.

Active work on the mill will be started at an early date and pushed rapidly to completion. An analysis recently made by E. H. Ducher, of Pennsylvania, shows the lime rock and shale to be first class cement material.

The city of Pittsburg is considering the erection of a new reinforced concrete market house to cost \$905,100, to replace the old structure on the Diamond Square. The structure is to be three stories high and have an arcade in line with Market Street, an auditorium capable of seating several thousand people.

Lud Schultz, of Eau Claire, Wis., has purchased a grove for the purpose of erecting a factory, in which he will manufacture concrete blocks and brick.

The White Cement Building Co., of Aberdeen, S. D., has dissolved partnership. It was composed of Ed. White and E. J. Hamill.

H. F. Seiter, secretary of the Tracy Cement Co., of Tracy, Minn., has purchased machinery to manufacture cement sewer pipes.

A. G. Englund of Starbuck, Minn., will establish a cement factory there. He will manufacture artificial stone for monumental and decorative purposes.

The Zenith Furnace Co., of Duluth, Minn., have been experimenting by manufacturing concrete blocks from slag.

A coal dust explosion at the Aetna Portland Cement Co., plant at Fenton, Mich., resulted in the death of night foreman Andrew Corwin, William Harris, oiler and Syrin Hatt, employed in the coal grinding department, the coal dust having become clogged in one of the conveyors. Hatt and Harris were attempting to clear the same, when the explosion occurred.

PACIFIC COAST CEMENT PRICES DECLINE.

For the first time contractors on the Pacific coast will not have to rely upon foreign brands of cement to make up the heretofore shortage in American brands which now seem to be able to supply the demand from mills in the states of Washington, California, Kansas and Missouri. The California and Washington mills have reduced prices from 60 to 75 cents per barrel for cement, and the grades made in the middle west are suffering as a result of the slashing by the extreme western concerns. These grades are sold at \$2.50 to \$2.75 per barrel, depending on their standing for reliability. Owing to their distance from market, and the heavy freight, amounting to nearly \$1.50 per barrel against them, these eastern cements are not able to enter into a competition that means a cut below \$2.25, and even that figure loses them money on a basis of 85 cents per barrel at the factory.

California cement has dropped from \$3.05 per barrel March 1, 1907, and \$2.55 in March, 1906, to \$2.20 at present. Eastern and foreign cements have dropped from \$3.25 in March, 1907, and \$3 per barrel in March, 1906, to \$2.50 to \$2.75 for eastern and \$2.75 for foreign at present.

At an estimated average drop per barrel of 60c. for all grades, Seattle is saving, on an estimated cement consumption of 400,000 barrels per annum, a total of approximately a quarter of a million dollars for cement alone. Other building materials also have dropped and labor is somewhat cheaper; and it is estimated by a local dealer in building materials that the reduction in the cost of building here is not less than 25 per cent., which he figures, will greatly stimulate construction.

The Alling Construction Co., has been awarded the general contract for the entire building for Mr. M. Born, to be built in Chicago at 342 Fifth Ave., of re-inforced concrete.

The building is of re-inforced concrete 12 stories high. The width is 60 feet and the length is 100 feet.

They are in the market for cement, 3,000 barrels, sand, gravel, re-inforcing steel, plumbing, electric wiring, steam heating, painting, glazing, elevators, ornamental and miscellaneous iron, plastering, a large amount of fire proof windows and sheet metal, sprinkler system, marble work.

CITY OF LOS ANGELES CEMENT PLANT.

Plans and specifications have been prepared by the aqueduct department of the city of Los Angeles for a cement plant which the city of Los Angeles is to build near Tehachapi, Kern Co., California. The following dimensions of the buildings are given: power house, 60x80 ft., raw storage bins, 80x600 ft., raw grinding mill, 76x90 ft., kiln building, 90x200, clinker storage, 80x200 ft., stock-house, 56x130 ft., oil storage, 40x200 ft., office and laboratory, 40x70. The contract for the power house has been let to the Lewellen Iron Works.

Three rotary kilns will be installed. The mill is to supply cement to be used in the construction of the great aqueduct, which is to supply the city with water.

The British American Portland Cement Company is reported to have located at Nowata, District No. 3, Indian Territory, where a plant will be built.

The Southwestern Portland Cement company of El Paso, Texas, has accepted plans for its proposed plant and work will be commenced at once on construction. The officers of the company are as follows: Pres., Carl Leonardt, Los Angeles, Cal.; A. Courchesne, Vice Pres., El Paso; Aman Moore of Los Angeles, Engineer of Construction.

The board of directors is composed of James D. Schuyler, Carl Leonardt, A. Courchesne, Aman Moore, Felix Martinez, J. F. Williams, Solomon Luna, Horace B. Stevens, Whitney Newton, O. J. Binford and C. Bodeker.

It is the intention of the company to advertise for bids for the construction of the plant at once.

The company's plant is to be erected in the Eagle Valley, 4 1-2 miles west of El Paso.

The Allentown Portland Cement Co., has purchased for \$20,000 the 116 acre farm of Jeremiah G. Rothermel, near Evanston, Berks Co., Pa., in addition to the Schmerk farm for \$30,000 both farms adjoin.

Havana Portland Cement Co., capital, \$3,000,000. Incorporators; Jason C. Cameron, Rutherford, N. J.; Frederick W. Bain, Brooklyn; Henrietta A. Bogert, New York.

The Lehigh Portland Cement Co. is reported to have closed an option on the Russel Farm near Mason City, Iowa.

The Southwestern Portland Cement Co., has 75 men at work cleaning up the ground for the foundations of two buildings 50x116 feet each. Materials of construction are being delivered on the ground just north of El Paso, Texas.

The Dakota Portland Cement Co., of Sioux Falls and Chamberlain, S. Dakota, has issued \$2,000,000 stock, \$1,000,000 common and \$1,000,000 preferred, the preferred is to bear 7 per cent interest which the company guarantees each purchaser of preferred to renew a like amount of common, John Flinn of Chamberlain, is soliciting stock subscriptions at Sioux Falls on the above basis.

The Prenton Cement Co., of Hamden Junction, Vinton Co., Ohio composed of New York, Philadelphia, Detroit, Boston, Cincinnati capitalists, held a meeting at the companies' club house on July 13, to discuss ways and means for developing the companies project. Over 40 interested parties were in attendance. The company owns 600 acres of land, conveying a high grade of coal. C. S. Cunningham, a practical mine expert has been employed to develop the mines. This work is now well under way.

Messrs. Dane & Biffle of Durant, C. H. District 25 Indian Territory are promoting a company to manufacture Portland Cement.

The Peerless Portland Cement Co., resumed operations during the first week in August after a shut down of two months, on account of slack orders and full storage bins.

The American Brotherhood of Cement Works will hold its next convention at Milwaukee on Sept. 8th with headquarters at Hotel Blatz. The business sessions will be held in the Pabst Theater.

The Monona Portland Cement Co., which was to erect a cement plant at Epes, Sumpter Co., Alabama, is to be dissolved by proceedings in chancery at Selma, Ala., the promoters being unable to finance the project.

A cement sidewalk paving firm at Altoon, Pa., has been detected in using inferior cement, which was placed in second-hand bags of companies making high grade cement. The city engineer was in the first instance blamed for passing bad cement on city work.

The Securities Company control Portland cement plants operating at Portland, Colorado, and Devil's Slide, Utah, and under construction at Three Forks, Montana, and El Paso, Texas.

The Mobile Cement Company, which is to build a plant near St. Stephens, Washington county, Alabama, obtained a local Alabama charter, capital \$5,000. The company is a Maine corporation with a capital of \$5,250,000. Work on the company's plant is to commence at once.

ACME CEMENT CO.

Aman Moor, Pres. of the Cement Engineering Co., of Los Angeles, Cal., is promoting a company to be known as the Acme Cement Company, capital \$2,500,000 to be located on the shores of Lake Pend Oreille, Kooteni County, Idaho, about 75 miles northeast of Spokane, Washington on the Great Northern Ry., and 77 miles northeast on the Northern Pacific Ry. of Spokane, C. M. Fassett of Spokane, and Carl Senhardt of Los Angeles are interested in the enterprise. The \$2,500,000 capital stock will be divided into 300,000, 7 per cent cumulative preferred stock, 2,200,000 common, with an authorized issue of \$900,000, 7 per cent, 20 year gold bonds. A large portion of the common stock will be given as a bonus to purchasers of the gold bonds. The company propose to lay down cement at Spokane at \$2.00 per barrel, being a reduction of \$1.00 per barrel on present prices.

The Corydon, Ind., Democrat in its August 6th issue, says: Mr. J. C. Brewer, of Pittsburg, Pa., who has held options on 800 acres of land on the Kentucky side of the Ohio river in Meade county, directly opposite New Amsterdam (Harrison county), Ind., has ordered deeds for the land, which carries large deposits of lime rock suitable for making Portland cement. The people of New Amsterdam and vicinity are much elated over the prospect of having a cement plant erected on the land in question in the near future.

The White Portland Cement Company's partially completed plant, near Manchester, Washtenaw Co., Mich., is being dismantled, the citizens of Manchester

who donated cash for the site upon which the plant was located and the right of way to the same, have filed a bill in equity for an injunction to restrain the wrecking of the plant on the ground that the money and land donated was made to trustees conditional on the completion of the plant. W. L. Watkins of Ann Arbor, receiver of the Cement Co., who sold the plant under a decree of court to Mrs. Steritz claims the trustees slept on their rights of being present when the judicial sale was made and hereby consented to the sale.

The Southern California Portland Cement Co., which has been constructing a large plant at Riverside, upon which work was suspended over six months ago, has received orders to renew construction work. from Oakland, California, the present headquarters of the company. W. W. Pool is general manager in charge of construction work. The exact location of the plant is known as Crestmore, not a postoffice. Local newspapers report that \$750,000 has been expended on construction work and machinery, which is from Germany. Most of the machinery is on the ground.

EAST AFRICAN SLEEPING SICKNESS.

The sleeping sickness prevailing in East Africa has been investigated by Professor Koch, who spent eighteen months on Sesse Island, Lake Nyanza. The disease is caused by an insect known as "Glossina Palpalis," which breeds on the banks of lakes and rivers. The chief means of combatting the disease consists of a sub-cutaneous injection of arsenic, with constant medical attendance of specially trained physicians. Professor Koch has ascertained that there is a distinct connection between crocodiles and sleeping sickness. Wherever crocodiles are found the disease may be discovered, but only in places near the banks. The blood of crocodiles forms the chief nourishment of glossina. The extermination of the glossina is impossible, but the same end may be reached by destroying crocodiles or by the removal of bushes and undergrowth where the animals lurk.

H. C. Millette, a concrete engineer of Los Angeles, Cal., has been retained by the Los Angeles County Highway Commission at \$8 per day to prepare estimates for con-

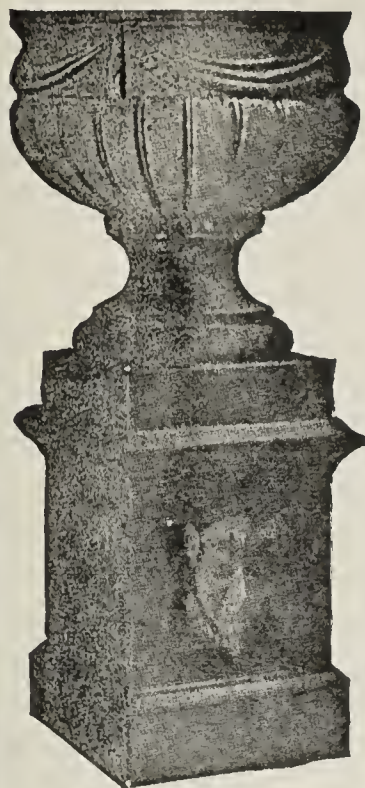
crete bridge work to be used in the commission's annual report.

INTERLOCKING REINFORCED CONCRETE BLOCKS.

An entirely new form of concrete building construction, being the invention of Geo. A. Peterson of Oakland, California, manager of the Interlocking Stone Company of the same place. The block consists of a face plate with two projecting lugs on the back, a wire re-inforcement embedded in the center of the block. When two blocks are placed end to end the projecting wire ends are twisted together and locked together, while horizontal and vertical steel reinforcing bars are embedded in the concrete, while skeleton steel columns are built up between the projecting lugs wherever required, forming a complete self-sustaining steel structure embedded in the concrete. This greatly simplifies the structural details, as there are either grooves or openings in the block to receive the steel bars so that the work can only be assembled upon true and correct lines. Where required, joist and girder stirrups and anchors are provided, always embedded in the concrete. A large four-story building on this construction, built before the earthquake at Oakland, California, passed through the earthquake shock practically unharmed, requiring only a few slight repairs, while a new brick factory building within two blocks was completely destroyed, and a one-story brick flax mill on the opposite side of the street was leveled to the ground. The Interlocking Stone Co., 563 Ninth street, Oakland, Cal., operating under the Peterson system is doing a thriving business in San Francisco and vicinity. The Interlocking blocks are produced on a hydraulic press capable of exerting a pressure of 1,000 tons, the machinery being built at their own works for the trade.

Twenty concrete block factories are now in operation in the City of Mexico, eighteen of which are operated by natives who use plaster molds for straight work and glue molds for under-cut work. Two concerns use American cement block machinery and do the best work. Up to Sept., 1907, mould from the U. S. valued at \$50,000 have been imported into Mexico for use in the capital city and vicinity, one concern alone having an equipped value at \$24,000.

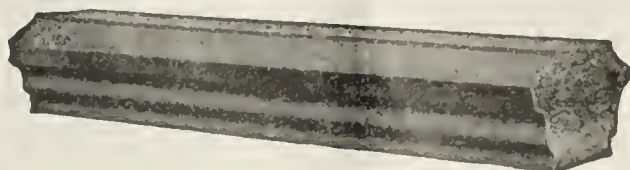
You Make a **LIVING** On Your Staple Product but you make your Big Profits on your Concrete **SPECIALS**



Fancy molds are the big profit-earning special of the Concrete Industry. Are you getting your profits; or missing your opportunity?

A LAWN VASE like this can be made for \$1, and sold at an average price of \$5 to \$7.

WOOD PORCH COLUMNS, with composition cap usually cost \$7 to \$10 each, (and in a few years they rot at the base); A Miracle Concrete Column (in any of the standard designs) costs you \$2 to \$3 to make and can easily be sold at the price of wood, for they last forever and are cheap at \$10.



PORCH RAIL like this, is in frequent demand.

It is easy to make, can be turned out at 10 cents per running foot, and sells readily at 50 cents per foot.

Manitowoc, Wis., May 20, 1908.
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Minneapolis, Minn.

Dear Sirs:—The Lawn Vase Mold was received this week and it is a dandy. I have made up some of the vases and am selling everybody I show them to. Sold six yesterday to one man at \$5.00 per.

There certainly is a great opening in the ornamental stone business, as the margin of profit is to say the least,—good. The profit on the first eight vases we sold was more than the cost of the outfit.

Respectfully yours,
H. MURPHY

LET US SEND YOU OUR NEW SPECIAL FANCY MOLD CATALOG

Miracle Pressed Stone Co.

MINNEAPOLIS, MINN.

Largest Manufacturers of Concrete Machinery in the World.

"SUNFLOWER BRAND" PORTLAND CEMENT

Always a favorite with the trade
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ALUMINITE FIRE BRICK

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Brick made **Especially** for this purpose with high **Aluminous Clay** and burnt at a higher temperature especially made to carry a **Heavy Scale** in **Rotary Kilns**. : : : : : : : : :

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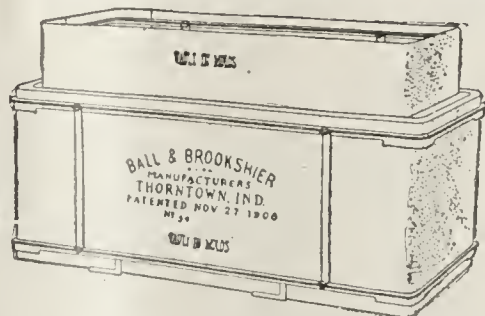
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ALL STEEL, no wood to shrink, swell and warp; always ready, without repairs, and good for a lifetime.

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CEMENT VAULTS

Makes valuts with Circle Corners, preventing cracks; corners strongest portion

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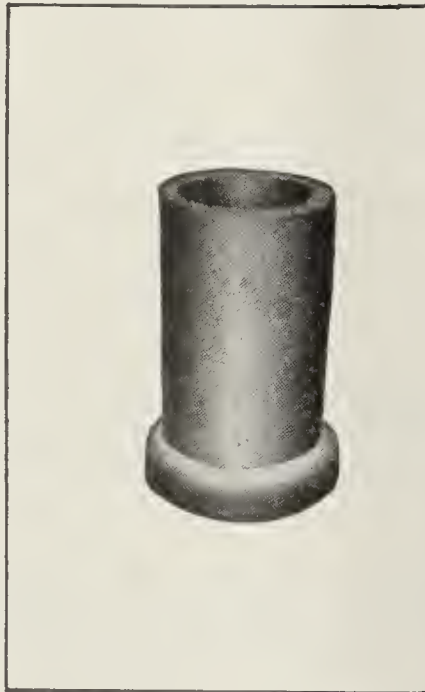
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YOUR HARVEST SEASON IS SOON TO OPEN.

Are you equipped to get all the profitable business in your line? Take sewer pipe. \$34.50 will equip you with a 15" bell and pipe mold. This size is mostly used by road supervisors for culvert work. The profits on one hundred foot of his pipe sold at clay prices will pay for a mold. This is certainly worth investigating. Had you not better send your order for a 15" size today?

CLARINDA TILE & BRICK FACTORY

PAUL O. COOK, Proprietor

Clarinda, Iowa, Dec. 17, 1906.

Miracle Pressed Stone Co., Minneapolis.

Gents:—The tile molds I find to be just the thing. We had a good sale of the tile, it was late in the year to buy these tile molds but we had a good trade. We made about 3000 ft. of 12 in. tile; 2500 ft. of 15 in. tile; and about 1500 ft. of 25 in. tile. I think they are better than clay tile. They will stand frost better, and the older they get the better they are. A clay tile is no better than the day it is put in the ground—cement gets better the longer it is in the ground. I know this to be true; I have made clay tile for 16 years and am still making them.

Yours PAUL O. COOK.

Miracle Pressed Stone Co.,
 Largest Manufacturers of Concrete Machinery in the World
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PERFECTION IN BLOCK MAKING

If you wish to attain this you should combine these three important features:

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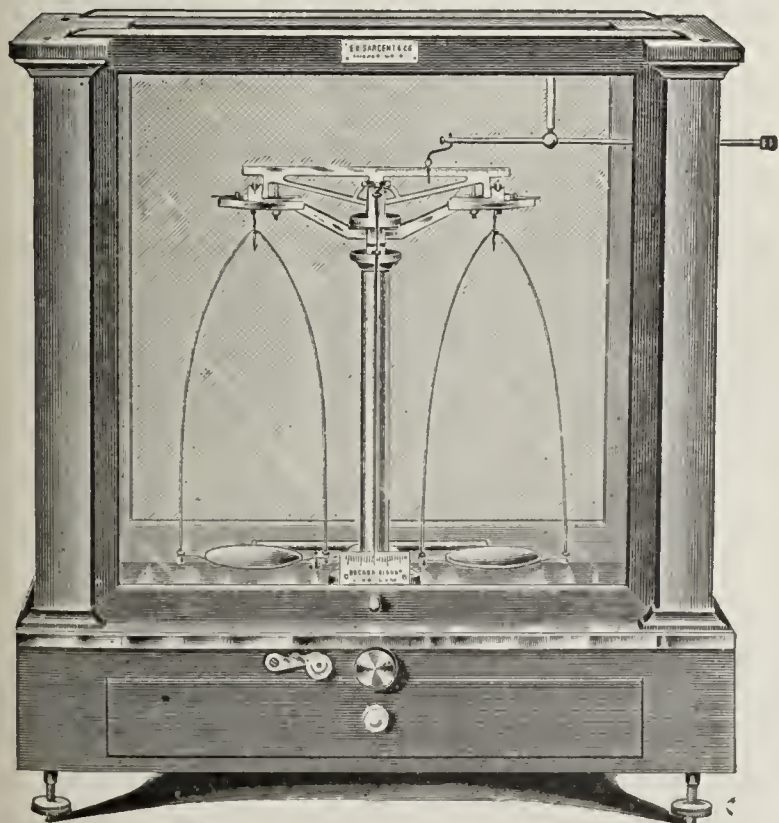
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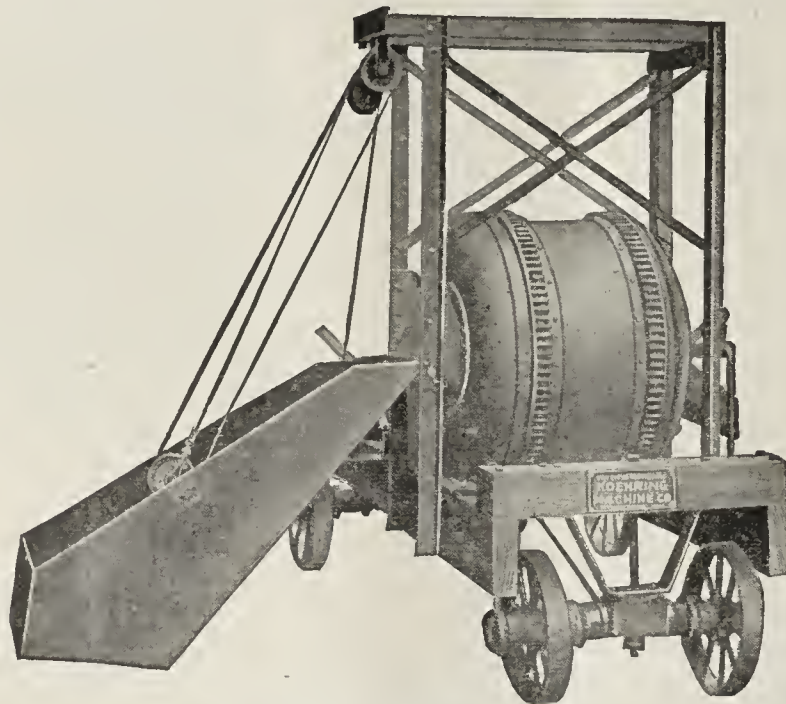
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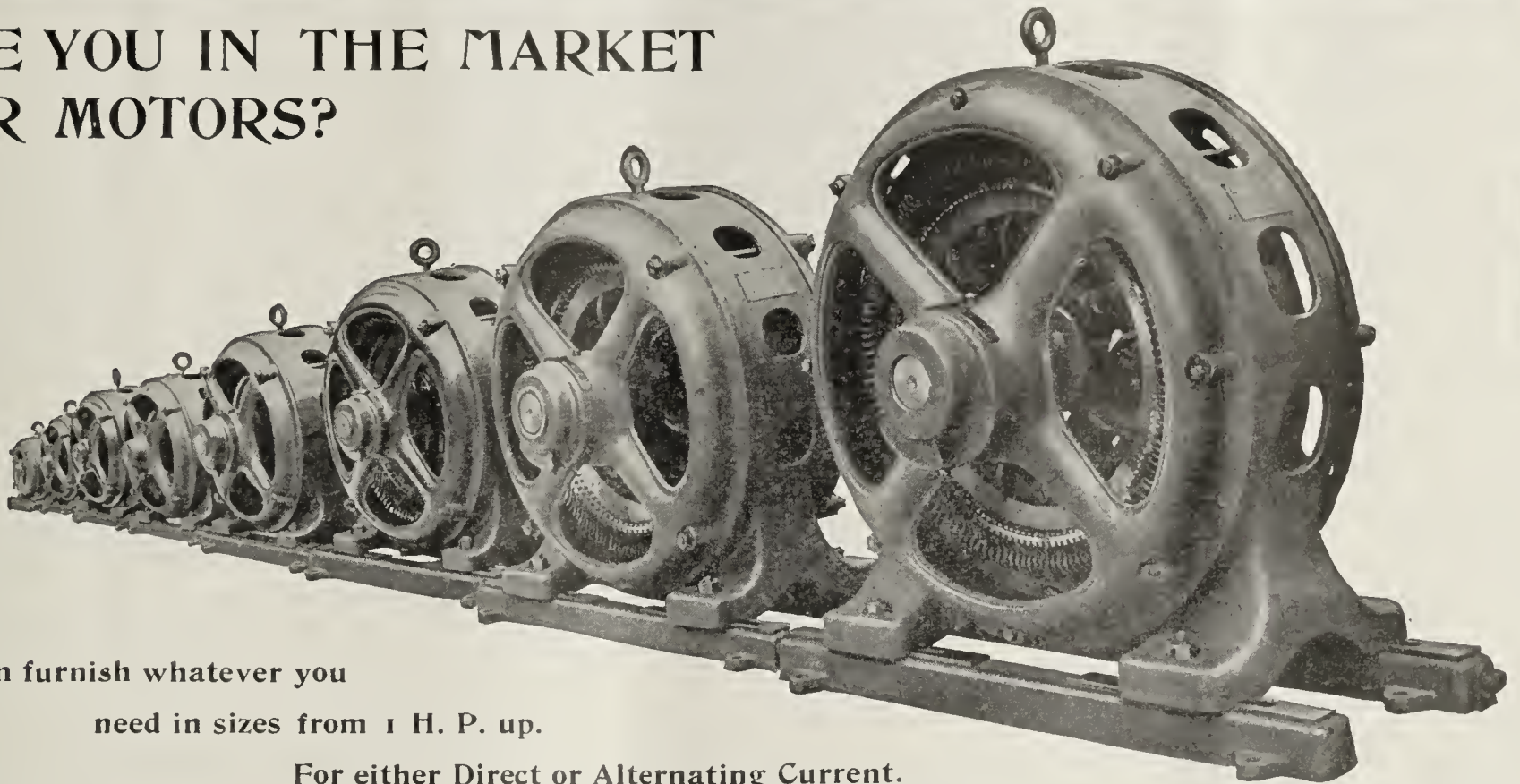
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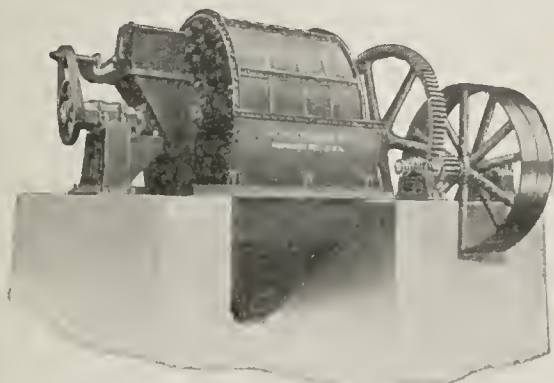
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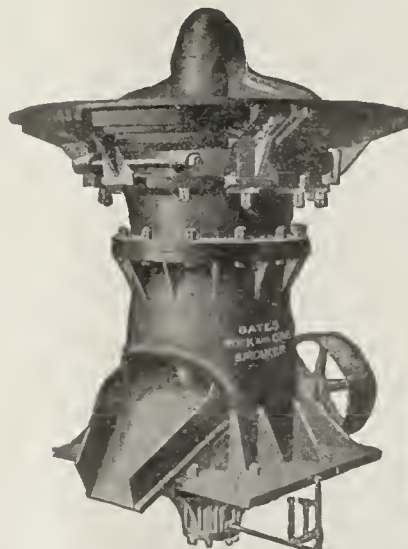
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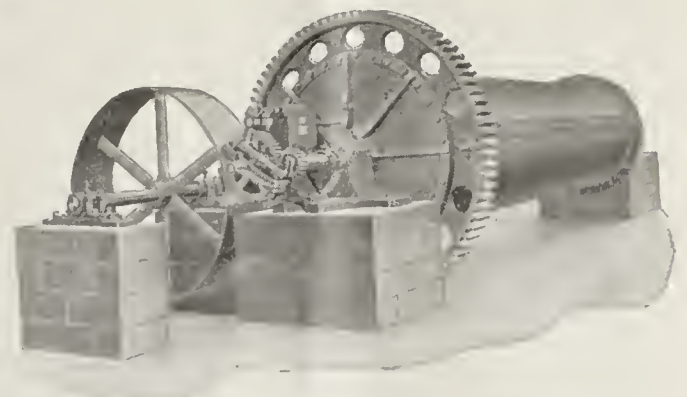
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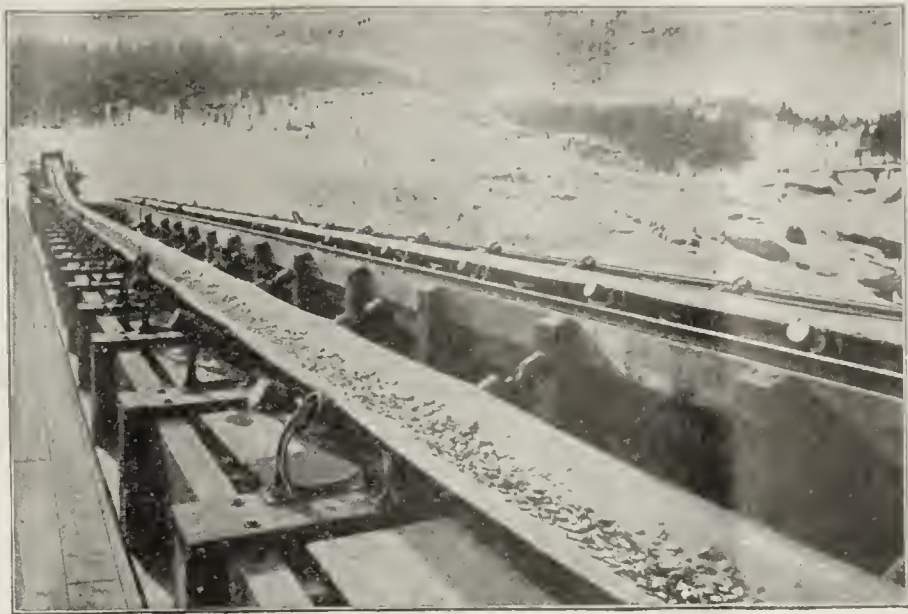
Mechanical Engineer, member American Society of Engineers, 14 years' broad experience in both civil and mechanical engineering. Last four years, manager and superintendent of cement plants, is open for position as above, or will contract to design and superintend the erection of cement plants on a percentage basis, guaranteeing production and manufacturing cost by operating plant for one year as manager after completion, and forfeiting 40 per cent of engineering fee on failing to make guarantee.—L. L. Griffiths, Consulting Engineer. Box 793, Bedford, Ind.

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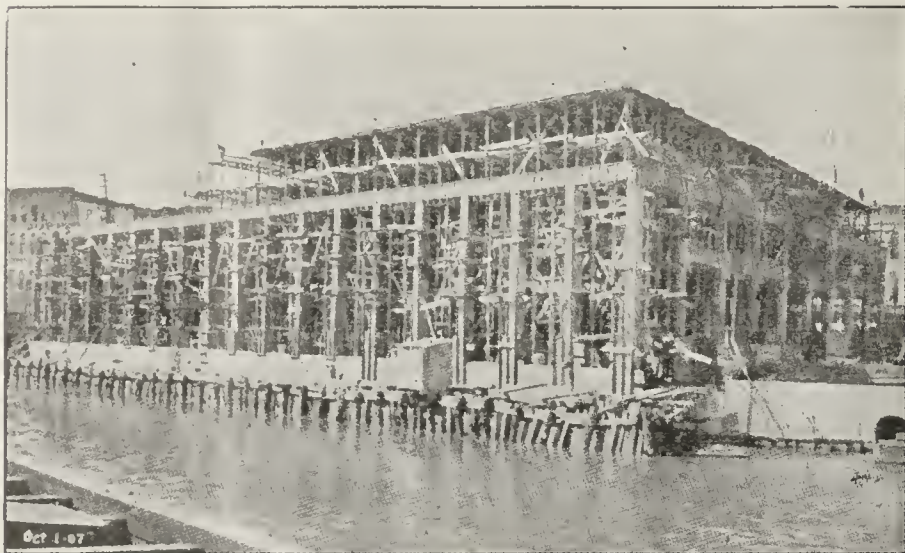
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Makes all concrete watertight



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Do not accept a substitute, as there are many adulterated compounds on the market.

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"Reinforced Concrete in Factory Construction"

a book containing, besides several general chapters on concrete, concrete aggregates, methods and materials for reinforcing—ten chapters giving detailed description of ten Concrete Factories and Warehouses erected in various parts of the country by different systems. The photographs, sectional drawings, and specifications for this book were furnished by the engineers in charge of the work.

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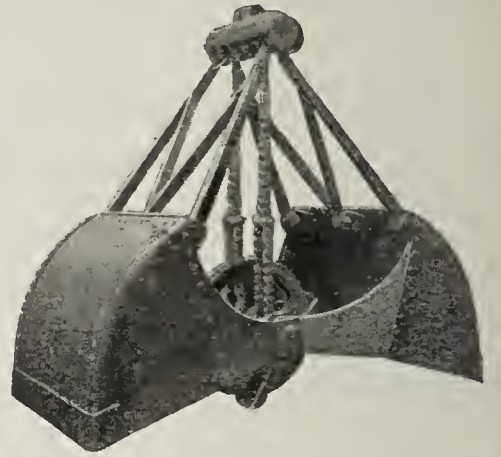
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ENGINEERING NEWS



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CONCRETE BLOCKED PAVEMENT. THE RUDOLPH L. BLOME COMPANY,
CHICAGO, ILLINOIS, OWNERS AND CONTRACTORS.

See Page 234.

CEMENT AND ENGINEERING NEWS

(PUBLISHED MONTHLY)

WILLIAM SEAFERT, Editor and Publisher

OFFICE—22 Fifth Avenue
Cable Address—"Seafert," Chicago.Entered at the Post Office at Chicago, as
Second-class matter, July 21, 1896,
under Act of March 3d, 1879.Subscription, \$2.00 Per Year
Foreign Subscription, . . . 2.50 Per Year

Advertising Rates Sent on Application

JOHN F. WALDRON, Advertising Manager

CHICAGO, SEPTEMBER, 1908.

CORRESPONDENCE.

We solicit correspondence on all matters of general interest to the cement trade in all its branches. Engineering notes, public improvements, and facts and opinions drawn from practical experiments will be welcome.

CONDEMNING CONCRETE SEWER CONSTRUCTION.

Mr. W. F. Fitzpatrick, an old offender, has been heard from again condemning concrete construction under the high sounding name and title of the International Society of State & Municipal Building Commissioners and Inspectors. This society was organized by Mr. W. F. Fitzpatrick, and is used by him to undermine public confidence in all kinds of concrete construction by means of certain bulletins issued in the name of the above Society. These bulletins are in reality written by W. F. Fitzpatrick; the society being simply used as a screen behind which Mr. Fitzpatrick hides his identity. The Fire-Proof Magazine was formerly Mr. Fitzpatrick's medium for condemning concrete. This magazine was the subsidized medium of the burned hollow clay tube industry which has millions of dollars invested in the manufacture of burned clay products.

Mr. Fitzpatrick's last attack is on concrete sewer construction. He says "People are growing skeptical in the use of reinforced concrete and will turn back to the ever reliable brick and steel and fire-proofing tile for standard construction, and that cities all over the country are awakening to the danger of sewers, septic tanks, and other municipal works made of concrete which are disintegrating and being injured by gases and chemical action of the sewage." Such statements are simply designed to pull the wool over people's eyes and thus prevent the introduction of concrete sewers. The same complaints were made against

the use of concrete sewers in London, Eng., over 40 years ago when chief engineer Grant first introduced concrete sewers in that city. The complaint was that concrete sewers were disintegrating, and upon making a thorough investigation of these charges, it was found that where the concrete pipe was connected with large mains built of brick, the brick disintegrated, while the concrete section remained perfectly sound.

In Germany, during the past ten years, many cities are taking up their brick sewers and are replacing them with concrete sewers on account of their more satisfactory wearing qualities.

Brooklyn, N. Y., Patterson, N. J., Milwaukee, Wis., have been using concrete sewers for the past 25 years with entire satisfaction; the same is true of the cities of Cleveland, O., and Harrisburg, Pa. Concrete sewers are superior to brick sewers in many respects; they are more easily flushed, and have a greater conveying capacity than

brick sewers, both having the same form and size. When Julius Caesar invaded England, he constructed concrete sewers, and water conduits in that country which are still in existence, after a life of over 2000 years. The burned clay industry is gradually giving away to the advance of concrete, and will continue to do so notwithstanding the assaults made by those having conflicting interests.

A LARGE CEMENT PROJECT.

The Knickerbocker Portland Cement Company has recently been organized in the State of New York with a capital stock of \$12,000,000, and owing to the strong men connected with it, there would be a certainty of something of importance being done in the cement world, were nothing definite known of the company's plans.

The first publicly known movement of the company was the purchase of more than 500 acres of land near Catskill, N. Y., with a large frontage on the Hudson River and



Sheldon H. Bassett, President of the new Knickerbocker Portland Cement Company.

with the main line of the West Shore railroad traversing the entire property. There are 350 acres of limestone deposits on the west side of the railroad, and 150 acres of shales and clays between the tracks and the river.

Edwin C. Eckel, formerly cement expert for the United States government, says that the land contains within its limits limestone, clays and shales sufficient and suitable for the manufacture of more than 400,000,000 barrels of high grade Portland cement. This statement is better appreciated from the standpoint of economical production when it is understood that bold limestone hills arise to a height of more than three hundred feet, thus enabling delivery by gravity of the limestone to any

materials has been demonstrated beyond question. The property adjoins that of Alsen's American Portland Cement Company. Work on the plant is expected to be started next spring and be completed within twelve months thereafter.

The Knickerbocker company now makes the second and most important move—the purchase from the Hudson Portland Cement Company of Hudson, New York, all of its property containing over thirteen hundred acres of limestone, shales and clays, with ample river frontage, on which property is now located an electrically driven Portland cement factory of a present capacity of 2,000 barrels a day, a warehouse with a storage capacity of 225,000 barrels, modern devices for unloading coal

By the purchase of the only Portland cement plant in the United States east of the Hudson River, the company will be placed in a commanding position especially as regards the Portland cement markets of New England and Eastern New York, having a differential freight rate favorable to it, as against the great Lehigh Valley district of from seven to twenty-eight cents per barrel. This taken in connection with the nine cents a barrel water rate to New York, and a relatively low rate to all other seaboard cities, gives a clear freight differential of not less than eighteen cents per barrel to a territory consuming millions of barrels of Portland cement annually.

Owing to the location of these plants on main lines of great rail-



Hudson Portland Cement Plant at Hudson, N. Y., which is to be controlled by the Knickerbocker Cement Co.

one of several favorable factory sites upon the Hudson River frontage, which gives the company the cheapest possible facilities for tidewater loading of the finished product into barges or seagoing vessels which will carry it direct to New York City at a freight cost of not more than nine cents per barrel, and to other eastern coast cities at relatively low rates.

The Knickerbocker Portland Cement Company has contracted with the American Cement Engineering Company, New York, to erect on this property a plant containing machinery of the most efficient type, thoroughly up to date in every respect, and which will turn out not less than 2,000,000 barrels of cement annually. The quality of the raw

barges, and short spurs connecting with the main lines of both the New York Central and Boston & Albany Railways. The warehouse is at the river's edge, and vessels are loaded direct therefrom for New York or any seaport in the world. This company's famous "Hudson" brand of Portland cement, has easily fulfilled the most drastic requirements of the United States government in both land and under water construction.

Contracts have already been let to American Cement Engineering Company for the enlargement of this plant from 2,000 barrels to 6,000 barrels a day, and plans for reconstruction work are being prepared. This plant will be pushed to completion as rapidly as possible.

ways and on tidewater, with economical coal handling devices, the important matter of fuel for economical burning of raw material is most favorably provided for. Everything considered there are no other cement plants in the United States so perfectly situated for producing and marketing Portland cement cheaply. The extent of the raw materials at Hudson exceeds those on the property on the west bank of the river.

Efficient management of industrial enterprises is as essential to success as are favorable locations, ample high grade raw materials and up-to-date plants. The phenomenal success of Mr. Sheldon H. Bassett, as president and general manager of The Iola Portland Cement Company, of Iola, Kansas, attracted the

attention of the Knickerbocker people, and he was, at an early date requested to investigate the plans and properties of the Knickerbocker company, with a view to becoming prominently identified with its management. Mr. Bassett, quickly grasping the unusual possibilities offered in the situation as outlined, decided to resign as general manager of The Iola Portland Cement Company and accept the presidency and general

the stockholders whom he represents.

MIRACLE BLOCKS IN NEW ZEALAND.

The accompanying photograph has been furnished us by the Miracle Pressed Stone Company of Minneapolis and shows the first house erected in New Zealand of Miracle double air space blocks. It is a 6-room cottage with all modern improvements and is located at

The Bath Portland Cement Company, of Bath, Pa., has secured a 1,000,000 barrel contract from the city of Havana, Cuba, to be used in constructing a sewerage system in that city. The cement is to be delivered within a year.

CEMENT CONSTRUCTION IN MEXICO

Company's plant at Colton started up on Sept. 1. One kiln only will be operated for the present.



First house erected in New Zealand of Miracle Blocks.

management of the Knickerbocker company. e was therefore elected its president and general manager, and has a considerable portion of his personal fortune invested in the enterprise.

Mr. Bassett's wide and successful experience in operating for the Iola company, one of the largest single Portland cement mills in the west, renders him eminently qualified to discharge the duties required in his new position. When Mr. Bassett assumed charge of the Iola plant, its daily capacity was about 3,000 barrels. Under his management the plant was enlarged to a daily capacity of 5,500 barrels, and regular dividends of 7 per cent. on the preferred stock were paid, as well as regular dividends on the company's common stock.

Mr. Bassett is a man of large business capacity, at once careful, cautious and progressive, an untiring worker and ever watchful to conserve and advance the interests of

Lower Hutt, Wellington, New Zealand. Considerable originality is shown in its construction and it is altogether a very good example of what can be done with a simple outfit by a man who will give attention to details and make an effort to excel.

Cement Construction in Mexico.

U. S. Consul General A. L. M. Gottschalk, of the City of Mexico, has made a report for the U. S. Department of Commerce and Harbor on the use of cement in Mexico from which we abstract and condense the following:

IMPORTS OF CEMENT INTO THE UNITED STATES.

WHERE FROM	JULY				SEVEN MONTHS ENDING JULY			
	1907		1908		1907		1908	
	Quantity in lbs.	Value in Dollars.	Quantity in lbs.	Value in Dollars.	Quantity in lbs.	Value in Dollars.	Quantity in lbs.	Value in Dollars.
United Kingdom . .	25,032,420	\$88,910	67,200	250	132,771,216	\$458,002	49,025,510	\$193,071
Belgium	11,083,541	29,800	568,228	\$1,411	168,714,696	492,919	89,168,908	286,165
France	1,488,000	5,094	370,100	1,619	7,693,300	27,993	4,257,605	15,706
Germany	25,623,118	86,963	8,795,012	35,773	191,842,904	606,368	78,134,296	265,445
All Other Europe . .	198,414	558	.....	.....	927,763	2,109	1,379,048	5,098
British North Am. .	32,500	165	311,500	1	145,000	902	319,050	1,682
Other Countries . .	1,316,079	7,008	11,905	60	4,238,218	22,509	345,019	1,912
TOTAL	64,774,072	218,498	10,123,945	40,727	506,333,097	1,610,802	222,629,376	769,079
Domestic Exports of Cement, bbls. . . .	87,837	149,155	87,070	129,969	485,186	809,086	529,290	809,376

There were 6,973,246 lbs. of imported Roman and Portland Cement, etc., in the United States bonded warehouses in July, 1907, valued at \$18,906, against 20,177,977 lbs. in July, 1908, valued at \$78,444.
For seven months ending in July, 1907, there were 62,053 tons of asphaltum imported in the United States, valued at \$269,443, against 82,059 tons imported in seven months ending July, 1908, valued at \$350,700.

There is a great future for the use of cement in the larger cities of Mexico. Some 300 concrete houses have been built in the City of Mexico during the past few years. Concrete construction is beginning to find favor with architects and builders. Considerable bad work having been done by speculators who put upon the market badly made concrete blocks, causing cement work to be condemned. The earthquake of April, 1907, made a thorough test of several well constructed concrete block houses, which stood the shock better than surrounding buildings of other materials. This has given concrete block construction the preference.

Twenty concrete block factories are now in operation in the City of Mexico, eighteen of which are operated by natives who use plaster molds for straight work and glue molds for under cut work. Two concerns use American cement block machinery and do the best work. Up to Sept. 1907, mould from the U. S. valued at \$50,000 have been imported into Mexico for use in the capital city and vicinity. One concern alone having an equipped value at \$24,000.

Sidewalks and Sewer Pipe.—An important item in recent importations of concrete machinery from the United States has been sewer-pipe molds, made by a firm of Minneapolis, Minn. I am told that importations of this article to the value of \$9,960 United States currency have entered the country within the year.

Concrete sidewalks are in use in practically every large city in the Republic, and the older-fashioned stone-flag sidewalks are gradually being relegated to such towns as are still unfortunate enough not to possess railroad transportation for the carrying of cement.

Concrete roofing, made in slabs 1½ feet by 3, 4 inches thick and ribbed, and joined together by asphalt joints, are made here by the firm of J. G. Zwicker & Co., under a United States and Mexico patent. These have been used very satisfactorily on roofing one or two public buildings and several private residences of the wealthy.

Reinforced Concrete.—It is only quite recently that the system of reinforced or "armored" concrete for buildings has been taken up by Mexican architects. Up to the present time there are but few examples of such buildings in this city, one or two of them large dry-goods stores. The systems best known are the Kahn (of the United States) and the Hennebique. Four such new buildings are about being completed.

Steel bars for reinforcing have been imported, but only in small quantities thus far, from the United States. Some expanded metal of English manufacture and some American rib metal have also been imported. Quite recently a fairly heavy tonnage of corrugated bars and similar material has been ordered by the Mexican Government from two American concerns.

Mexican Cement Plants.—There are at present three cement manufacturing plants in the Mexican Republic. One is that owned and controlled by the Compania Bancaria de Obras y Bienes Raices, situated at Dublin, State of Hidalgo, and only a short distance from this city. A much smaller plant is that of Arenzana & Co., on the outskirts of the capital city. The third is the Monterey Steel & Iron Company, of Monterey, State of Nuevo Leon, which sells some of its product in this city. The Dublin plant turns out an excellent cement of the Portland type, which is said by persons competent to judge to be quite the equal of the imported article. It has a capacity of some 1,000 barrels per month, but expensive and radical enlargements are under way there which will bring the factory's output, or at least its working capacity, up to 1,000 barrels per day. The so-called "Forsythe" process, which is in general use in the United States for softening limestone where limestone is used in cement manufacture will be in operation there.

Importations.—The exact figures of Mexican importations of cement from abroad are somewhat difficult to determine, the article, "cement," being usually included in the Government statistics with others, such as lime, carbonate of lime, etc. Germany appears to have been the chief source of importations, probably owing to her cheap ocean freights. One American concern sends large consignments to Mexico regularly; but the German market seems on the whole to be considered cheaper and better. I have heard of large consignments coming occasionally from Belgium and England.

I am informed that approximately 600,000 barrels was the total importation of the year ended June 30, 1905; that the next year's figures showed 750,000, and that in 1906-7 the importations rose to above 1,000,000 barrels. The Mexican Government, during the last-mentioned period, I am told, contracted with German firms for over 100,000 barrels; with an English syndicate for some 40,000, and with an American firm for 20,000.

The following paragraph is from one of the leading houses in the con-

crete manufacturing business regarding the future of concrete in Mexico:

"With reference to the future of concrete construction, whether it be either in the form of concrete block or reinforced concrete construction, it is very well seen that this new class of building material and construction is in its infancy, but it is very evident that it is going to take both time and patience in order to gain the confidence of both engineers and architects and builders with reference to the strength and stability of both concrete blocks and reinforced construction. As the fact must not be overlooked of existing conditions, such as earthquakes, which are very common in this country; but as a whole it is the writer's belief that one year from to-day there will be 50 per cent more concrete used than there is at the present time.

CEMENT PRODUCTION FOR 1907.

The cement output for 1907 in this country was as follows: Portland, 48,785,390 barrels, valued at \$53,992,551; natural cement, 2,877,700, valued at \$1,467,302; Puzzolan cement, 557,252 barrels, valued at \$443,998, the total of the three classes of cement production being 52,230,342, valued at \$55,903,851, showing an increase of 2.4 per cent in quantity and 1.1 per cent in value.

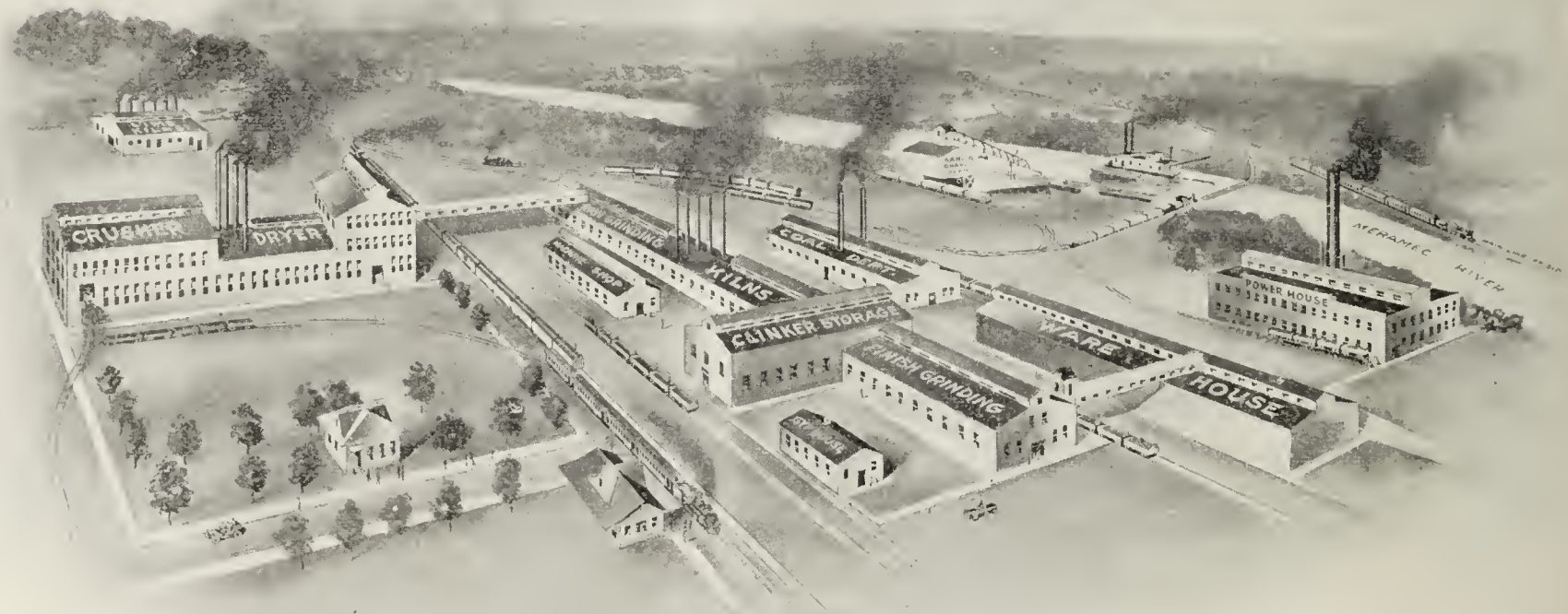
In the Portland cement branch of the industry, Pennsylvania, with a production of 20,393,965 barrels, valued at \$19,698,006, is still the leading state by a large margin. New Jersey, with an output of 4,449,896 barrels, worth \$4,738,516, is second; Indiana, with a production of 3,782,841 barrels, valued at \$4,757,860, is third; Michigan is fourth, with an output of 3,572,668 barrels, valued at \$4,384,731; and Kansas fifth, with an output of 3,353,925 barrels, valued at \$4,240,358. These five states contributed almost three-fourths of the total production, and none of the remaining states produced as much as 3,000,000 barrels during the year. The concentration of Portland cement plants in the so-called Lehigh district of Pennsylvania, with its New Jersey extension, continues. Here twenty-one plants made over 24,400,000 barrels, or slightly more than half the Portland cement produced in the United States in 1907. 876 were in operation in 1907, and 87 new kilns, will come into operation in 1908 with an average output of over 62,000 barrels per kiln per annum. The output for 1908 can be raised to 60,000,000 barrels per year.

THE NEW PLANT OF THE MERAMEC PORTLAND CEMENT AND MATERIAL COMPANY.

On the invitations of the officers of the Meramec Portland Cement & Material Company, of St. Louis, an excursion was made recently to Sherman, Mo., by the stockholders and others interested in the company. A special train was provided for the occasion. As a representative of Cement & Engineering News was among the guests of the company particulars

conducted across the company's tract to the Meramec River, on nearing which many of the machines and much of the material designed for use at the sand and gravel plant were in view, such as the patent buckets manufactured by the Hayward Company, New York, N. Y., and the centrifugal pumping machinery manufactured by the Morris Machine Works, Baldwinsville, N. Y., while at St. Louis waiting for the river to fall, there are six dredges

plant brought us to the foot of the hill where the lime rock will be quarried. Owing to the elevation of the ledges, it affords a gravity system of handling the raw materials, since later on when we came to view the deposits of shale, we found this material also at a similar elevation. Furthermore, there is an ample supply of both lime rock and shale to provide for the manufacture of a high grade of Portland cement, even if the plant was to land cement, even if the plant was to



Portland cement, sand and gravel plants, under construction near St. Louis, Mo., for the Meramec Portland Cement and Material Co. The sand and gravel of this company is one of the largest in the country and the material is handled by Hayward patent buckets, manufactured by The Hayward Company, 50 Church street, New York, N. Y. The cement making machinery, such as the tube mills, dryers, crushers and kilns will be furnished by the Power & Mining Machinery Co., Cudahy, Wis.; boilers, eight in number, 316 H.P. each, by the Heine Safety Boiler Co., St. Louis, Mo.; pulverizing machinery, by the Bonnot Company, Canton, O.; centrifugal pumping machinery, by the Morris Machine Works, Baldwinsville, N. Y.; conveying machinery, by the H. W. Caldwell & Son Co.

can therefore be furnished concerning the visit.

It being the purpose of the company to develop facilities for utilizing the sand and gravel deposits of the Meramec River, which bounds the southern part of their land, before building the cement plant or engaging in the manufacture of lime, their attention has first been given to this department of their business.

Under the guidance of Mr. Frank P. Boyd, Vice-President and General Manager, the body of gentlemen on leaving the cars at Sherman were

on which considerable machinery will be brought forward.

The elevator facilities, conveying arrangements and storage bins are well under way and the piling along the river bank to act as an apron is nearly all driven in place. There is a large deposit of sand and gravel at this point in the river, exceeding forty feet, which is the limit at which it is expedient to pump the material. The company expects to complete this department by August.

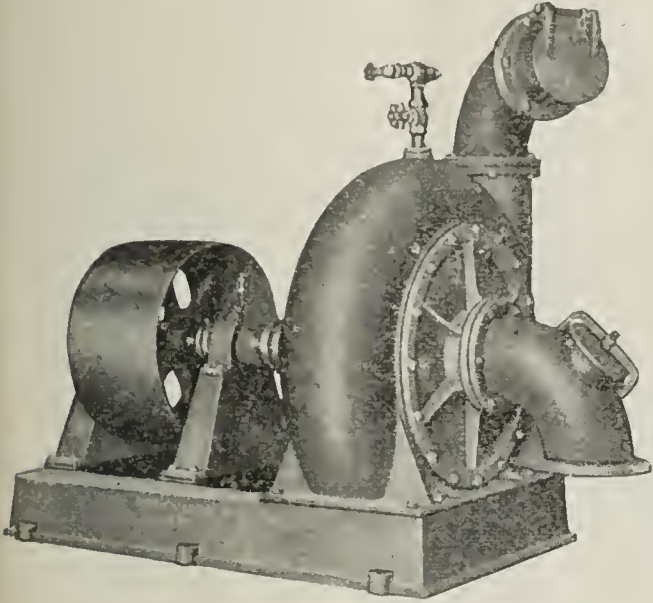
A tramp across the open tract, which is to be the site of the cement

be run at its full capacity (2,500 barrels daily) for a term of seventy-five years. Also it so happens there is very little stripping required. These facts have been ascertained by thorough inspection, and as to the quality of the materials, that has been demonstrated by practical tests by the highest authorities in expert knowledge of cement materials and manufacture.

The engineer of the cement plant is O. H. Sarody and the contractor for building it is the C. L. Gray Construction Company of St. Louis. This

company is also erecting the sand and gravel plant.

The location of the works is at Sherman, on the Missouri Pacific railroad, about sixteen miles from St. Louis. Close at hand is the 'Frisco road, consequently the company will enjoy ample shipping facilities. The company's property comprises 260 acres. A St. Louis real estate company has purchased a tract adjoining



Morris pumps installed in sand and gravel plants of Meramec Portland Cement and Material Company's plant. Made in Baldwinsville, N. Y., by Morris Machine Works.

the property and will proceed to erect homes for the use of the employes of the Meramec Portland Cement & Material Company. The new settlement will be known as Boyd City. The tube mills, dryers, crushers and kilns were manufactured by the Power Mining Machinery Co., Cudahy, Wis., boilers by the Heine Safety Boiler Co., St. Louis, Mo.; pulverizing machinery, The Bonnot Co., Canton, Ohio, conveying machinery, H. W. Caldwell & Co., Chicago.

CANTERBURY SCRAPER BUCKET.

The Clam Shell Bucket selected by The Canterbury Construction Co. for the Sand Unloading Plant they have erected for The Meramec Portland Cement & Material Co., of St. Louis, Mo., is of the type known as the "Scraper Clam Shell" and was built by The Hayward Company of New York, N. Y.

This bucket is a remarkable example of the Scraper Type, being entirely different from any other make of bucket. In it may be found the result of many years experience in building automatic buckets, provision having been made for every condition of service and wear that the hard proposition of digging pumped river sand at high speed can present.

familiar rope and sheave tackle device in which the closing rope is reeved through a number of sheaves

The closing mechanism is of the disposed in the upper and lower cen-

ters of the bucket and dead ended at the trolley carriage of the hoisting tower. The holding line is passed under a single sheave in the upper center and also dead ended at the trolley carriage. This arrangement permits the bucket to be hoisted and trolleyed at the same time without any compensating mechanism on the operating lines. The advantage of this method of operation would be lost, however, by the increased wear and tear on the ropes were it not for the extreme care taken in providing against this wear in the bucket itself. The sheaves are unusually large and so arranged that there is no side friction on the rope. A novel form of guide sheaves are arranged on the upper center so that no matter what position the bucket is landed in or on the material in reference to the lead of ropes aloft, there is always a deflecting sheave automatically adjusting itself to the bend of the rope. Thus the operating ropes never come into contact with stationary surfaces in the bucket and all friction and cutting effects are eliminated.

To further safeguard the ropes the lower center is made so that the sheaves and ropes travel through a bath of clear oil which tends to wash out the grit and sand which they may

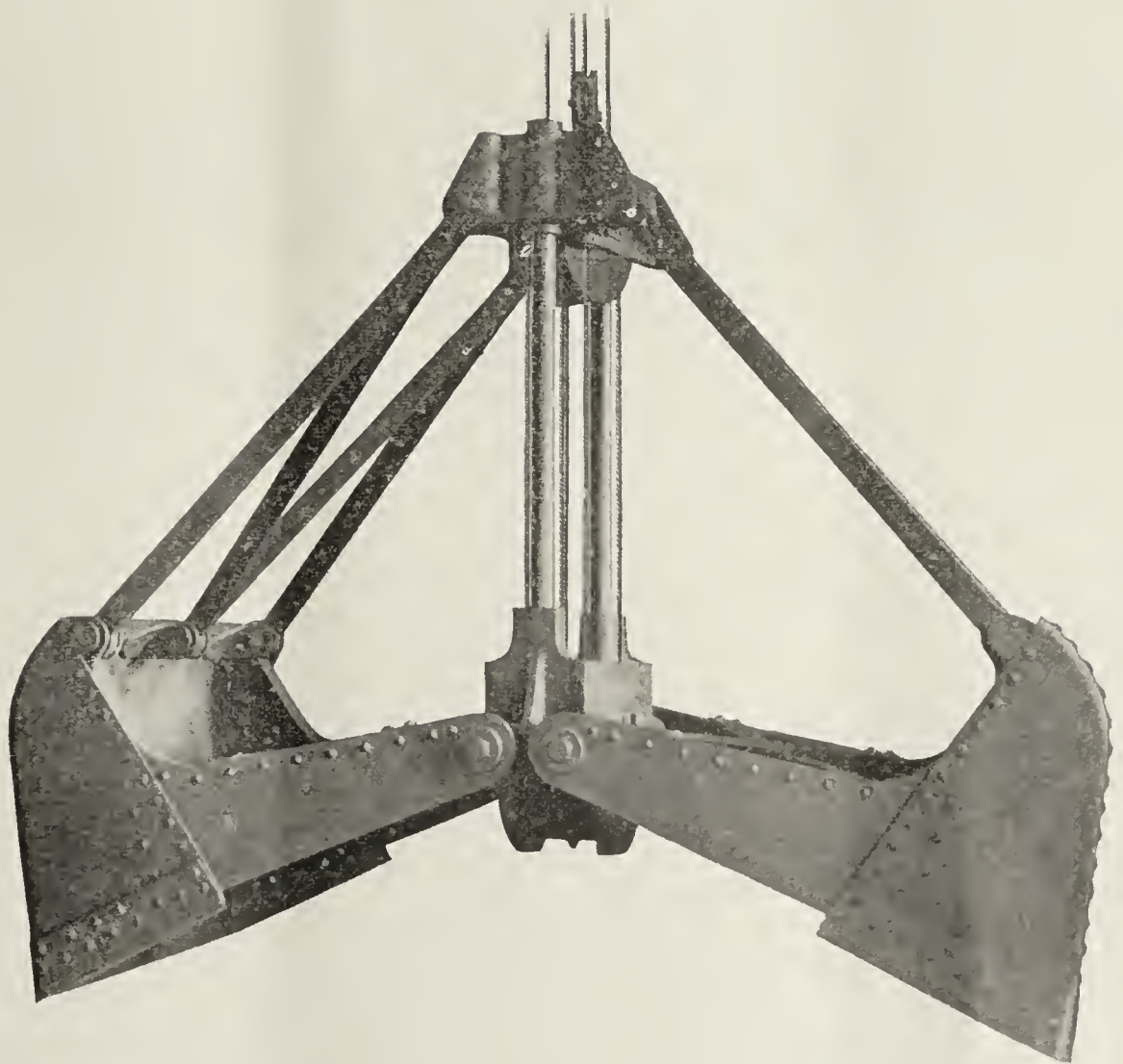
the bronze receives the wear in every case and all pins and bolts are preserved in good shape.

The connecting rods and bowl are made in the usual style employed in the Hayward Buckets, viz.: of forged and flanged steel securely braced against lateral shocks and movement. All rivets are countersunk in the bowl and all edges are chamfered or flush inside of same so that the bowl is absolutely free of all obstructions. The mouth of the bowl is entirely shrouded and protected by a heavy mouth piece or cutting edge.

The upper and lower centers are made of steel castings and arranged to receive a light steel sheave frame which contains the sheaves and protects the castings from wear.

Oiling provisions are made at all points, the sheaves being supplied through the pins which are of large diameter and contain oil chambers connected to cups at their ends.

Only two guides or slides are used in this bucket and their duty is comparatively light. These slides are hollow and round and hang perpendicularly from the upper center. They project through the lower center and serve to keep the two centers in alignment.



pick up. A clean-out is provided at this point for removing the sediment at the bottom of the lower center.

All hinge points throughout the bucket are provided with removable bronze bushings and so arranged that

The reach or opening of the bowl of this bucket is very long and the mouth pieces are comparatively wide, giving it the ability to fill in hard shallow material and to clean up large areas with few operations.

THE NEW DIXIE PORTLAND CEMENT PLANT.

The establishment at Richard City, Tenn., of the largest Portland cement plants in the South by the interests controlling the famous Nicholson group of cement plants is indicative of the great importance which these interests must have attached not only to the value and quantity of the necessary raw material deposits at this place, but also of the splendid field for the sale of cement in the South. Richard City is located 32 miles west of here, on the Sequatchie Valley branch of the Nashville, Chattanooga & St. Louis Railway, and on the Stevenson extension of the Southern Railway, which is now in course of construction, and is just over the boundary line between Alabama and Tennessee. A plant has been constructed involving the outlay of about \$1,500,000 and having many ideal features, these being made possible both from the splendid arrangement provided by nature and the long ex-

perience which these interests have had in the manufacture of cement. This plant of the Nicholson group, of which there are eight in various parts of the West, is known as the Dixie Portland Cement Co., and its product as "Royal" cement, and it will have an output of from 5,000 to 7,000 barrels daily.

the attention of capitalists the splendid advantages which are available along their lines for the location of industrial plants. It is also indicative of the appreciation which outside capitalists have of the advantages that can be profitably utilized from the many vast and important resources which the South contains in such abundance.

After a thorough investigation of this situation these interests were much impressed with the opportuni-

ties at this point for the establishment of a large plant that would manufacture a high-grade Portland cement and which at the same time presented such a fine selling field, and accordingly purchased between 500 and 600 acres of land, which was found to contain all of the necessary raw materials to provide for the indefinite operation of a plant of a large capacity, and work on the construction of the plant started.

Actual work on construction was begun in November, 1906, and was steadily pushed to completion, the first product being turned out in December, 1907. The plant was designed



Views of the new Dixie Portland Cement Mill. Equipment was furnished by the following firms, crushers, etc.: Power & Mining Machinery Co., Cudahy, Wis.; Griffin Mills, Bradley Pulverizer Co., Boston, Mass.; boilers, Heine Safety oiler Co., St. Louis, Mo.; conveying machinery, Webster Mfg. Co., Chicago; pulverizing mills, Lehigh Car Wheel and Axle Works.

In coming into this section of the country the management determined that it was going to become a real part of the growing South, and this determination has been so fully carried out that those residing in the neighboring towns have naught but the best of feelings for the company and have given evidences of their appreciation of the location of such a valuable industry. This broad spirit of management was further demonstrated

and erected by the Hunt Engineering Co. of Iola, Kans., which has a long and successful experience in the building of similar plants, Mr. Leigh Hunt, the president of the company, having designed and erected all of the other Nicholson plants, in addition to many others in different parts of the country. Direct supervision of the construction of this plant was under Mr. Ellis C. Soper, vice-president of the Hunt Engineering Co., and who is now acting as the superintendent of the plant pending its full completion.

The product of this plant is made by the wet process, which has been followed by the Nicholson group, because, in the opinion of the men interested, it was found to give a more uniform product, which is so much desired by cement users. This process consists of taking the pulverized limestone and shale as it comes from the mills and passing it through pug

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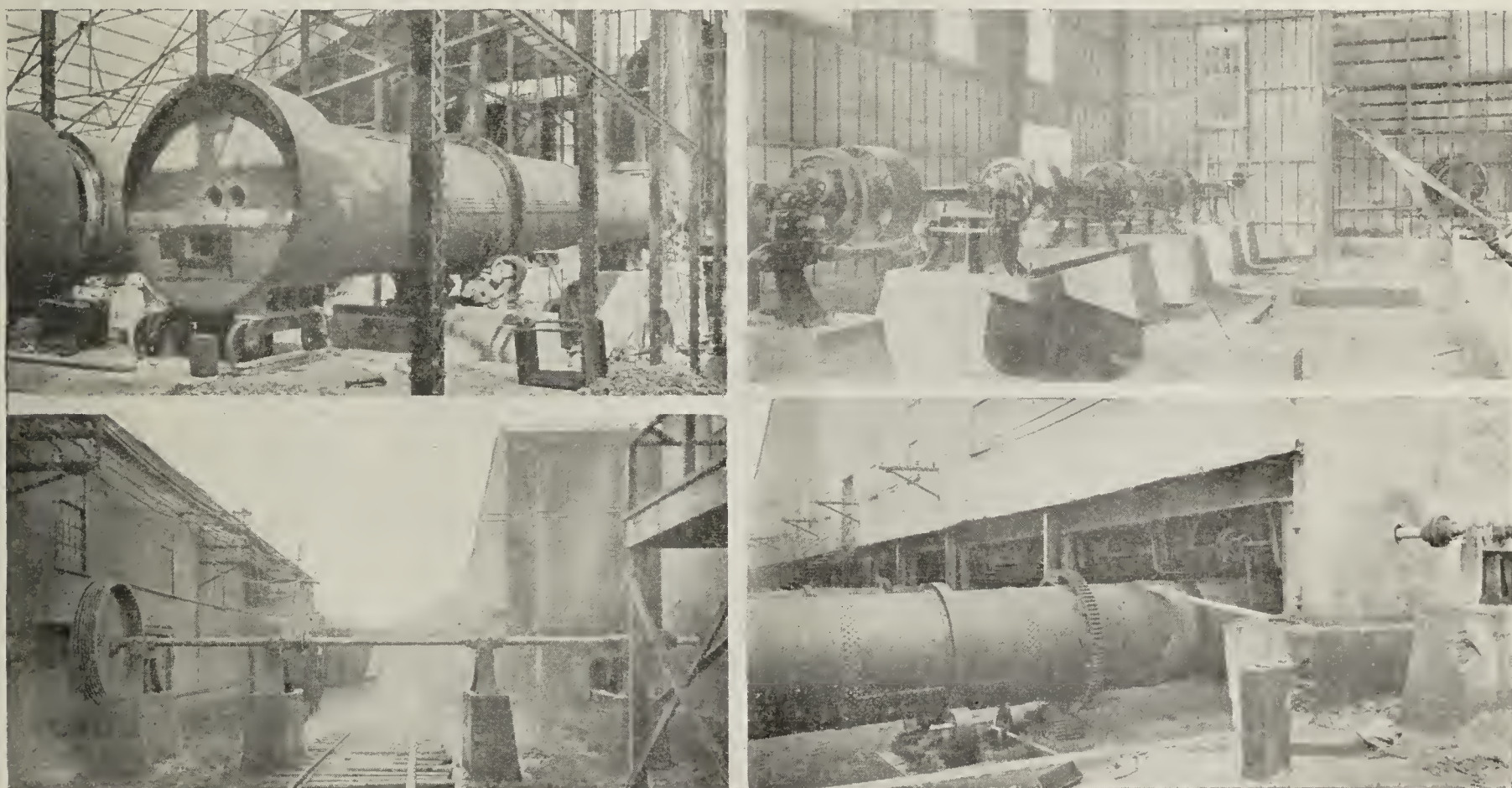
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mills, where it is mixed with water and then goes to tanks, where it is thoroughly agitated and mixed. This resultant mixture is termed "slurry," and has a consistency of soft mud, being fed into the kilns through pipes by gravity. The different tanks holding this slurry are constantly being tested and analyzed, and when one of them is found to be slightly off in chemical ingredients a central tank is used to mix it with the required ingredients from another tank to set it right, so that when the mixture reaches the kilns from any of the tanks it is always of the same chemical composition, and consequently gives the same uniform product at all times;

feet; raw grinding building, 101x182 feet; kiln building, 190x192 feet; finished grinder building, 67x214 feet; coal building, 52x160 feet; warehouse, 105x600 feet; upper power-house, 65x128 feet; lower power-house, 65x144 feet; machine shop and stockroom, 65x96 feet, and smaller buildings, such as blacksmith shop, carpenter shop, laboratory, oilhouse, barns, office and pipehouse. All of these buildings have heavy reinforced concrete foundations, and a number of them reinforced concrete walls and floors, while others have steel frames fireproofed with expanded metal and concrete, so that the buildings may be said to be typical of the industry. All roofs are of corrugated iron. The two power-

crusher platform. The quarrying is all surface work. The limestone is dynamited out, the holes for the charges being bored by compressed air rock drills. Very little manual labor is used at the quarry as all of the loading is done by two large steam shovels, these being of one and one-half tons capacity, and they pick up enormous pieces of the rock and quickly load them into the dump cars. The trackage from the quarry to the rock crusher is laid on a 2 per cent grade, thus enabling the cars to reach the crusher entirely by gravity. When emptied they are carried back to the steam shovels by electric hoisting engines.

The shale from the pit, which is



Views of the various machinery in the new Dixie Portland cement plant, showing one of the ten 125-ft. rotary kilns, Dodge lineshaft, etc.

in fact, it is the leading aim of this plan to produce at all times a thoroughly uniform mixture, and to insure it being so many other tests are made as the material is passing from one stage to another so the superintendent can always be kept informed as to the exact character of the material in any part of the plant.

In designing the plant an effort was successfully made to take advantage of the physical condition of the property, which was particularly well adapted to an ideal arrangement of the various buildings and to facilitate the passage of the materials through the different departments at the least possible cost. There are 10 large buildings and a number of smaller ones, covering in all about 20 acres of land. These include the crusher building, 75x100 feet; drier building, 80x105

feet; raw grinding building, 101x182 feet; kiln building, 190x192 feet; finished grinder building, 67x214 feet; coal building, 52x160 feet; warehouse, 105x600 feet; upper power-house, 65x128 feet; lower power-house, 65x144 feet; machine shop and stockroom, 65x96 feet, and smaller buildings, such as blacksmith shop, carpenter shop, laboratory, oilhouse, barns, office and pipehouse. All of these buildings have heavy reinforced concrete foundations, and a number of them reinforced concrete walls and floors, while others have steel frames fireproofed with expanded metal and concrete, so that the buildings may be said to be typical of the industry. All roofs are of corrugated iron. The two power-

house chimneys, which are each 150 feet high, are of reinforced concrete. The plant is automatic throughout in its operation, a series of belt, bucket and screw conveyors being used, so that from the time the raw material is dynamited in the quarry until the finished product is bagged ready for shipment it is not necessary to handle it in any other way. The plant is located at the base of the mountain from which the raw materials are obtained, the face of the main quarry being about 150 feet above the ground floor of the buildings, and the excellent arrangement provided here by nature can be readily appreciated from the accompanying photographs. The limestone quarry is at present opened for about a quarter of a mile, but this will eventually extend to one mile or one-half a mile on each side of the

about one-half a mile up on the mountain side, is conveyed to a storage tank by a belt conveyor 2,200 feet on centers, this being said to be the longest single belt conveyor ever installed, and the fact that it is laid on a grade makes it possible to operate it with a four-horse-power electric motor.

One of the features of this plant is the rock crusher, which is the largest ever built in the world. It is 18 feet 11 inches in height, and weighs 425,000 pounds, and will crush pieces of rock up to 3x5x10 feet at the rate of 800 tons an hour. This crusher is of the McCully gyratory type, and built by the Power Mining & Machinery Co., Cudahy, Wis., to meet the special requirements of this plant. Power for driving it is furnished by an electric motor. After passing through this crusher the stone goes through a re-

volving screen having a two-inch mesh the larger pieces being passed through to three 300-ton capacity steel tanks, from which they are fed to two No. 6 McCully crushers. From these the stone is carried by bucket conveyors and dumped into four 300-ton capacity steel tanks, adjoining which are two 300-ton capacity steel shale tanks, which store the shale as it is delivered by the long belt conveyors from the shale pit. From these tanks the stone and shale is delivered by chutes at the bottom onto a 42-inch belt conveyor, which carries the material to four driers and from these passes to four grinding mills. It is then conveyed by buckets to 11 tanks, which feed into 22 Griffin mills made by the Bradley Pulverizer Co., 92 State street, Boston, there being two of these mills to each tank, and they grind the material to a 95 fineness. From these mills the material is carried by screw conveyors to a belt conveyor, which takes it to two pug mills, where water is added, this be-

slurry is now ready to be fed into the kilns. This is done by piping, the slurry flowing by gravity.

The kilns are 10 in number, and are lined with brick made in Cleveland, O. Each kiln is driven by a 30-

Webster Manufacturing Co., Chicago, Ill.

The power for the operation of the plant is supplied from two large power-houses, one being devoted to the raw material end and the other



Lineshaft equipment for driving the Griffin Mills in the Dixie cement plant.

horse-power electric motor, and has a capacity of 500 to 700 barrels daily, making a total capacity of the plant from 5,000 to 7,000 barrels daily.

The coal burned in the kilns is dumped from a trestle into a tank, from which it is fed to a Patent Crusher mill and then conveyed to a 200-ton capacity storage tank. From these tanks the coal is passed through two driers and conveyed by buckets to four 200-ton capacity steel tanks and then fed to five Fuller mills made by the Lehigh Car, Wheel and Axle Works, Catasauqua, Pa., and which thoroughly pulverize it.

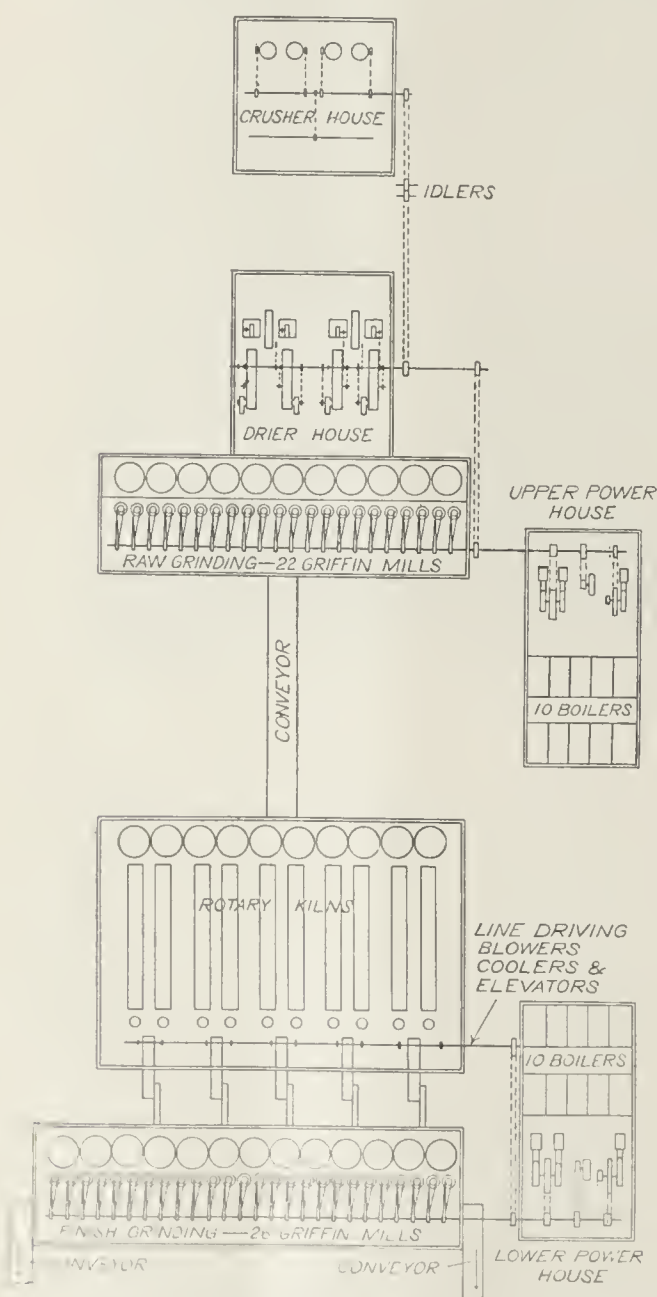
The pulverized coal is carried by screw conveyors to a series of coal tanks directly back to each kiln, and is blown into the kilns by eight high-speed fans.

After burning the clinker passes from the kilns into five revolving coolers and passing from these 2 per cent of gypsum is added by an automatic process which absolutely insures a proper mixture. The material then goes by a bucket conveyor system to 13 storage tanks, and is fed from these into 26 Griffin mills, where it is thoroughly pulverized and becomes the finished product. From these mills the cement is carried by screw conveyors, which carry it to the big warehouse, where it is stored into bins ready to be sacked. This big warehouse has a capacity for storing 300,000 barrels of cement. The sacking is done by seven automatic weighing and sacking machines, and the cement is then ready for shipment. A special system of trackage has been laid out next to this warehouse to facilitate the shipment of the cement, and as high as 8,000 barrels can be loaded daily.

The conveyor systems throughout the plant were furnished by the

to the finishing end. In each of these houses are two compound Corliss engines of 1,000 horse-power each. Each power-house is also equipped with a 400-kilowatt direct-current generator. Transmission of power is by the American system of rope drive, and all transmission machinery and equipment was furnished and installed by the Dodge Manufacturing Co., Mishawaka, Ind. Steam is supplied by 10 water-tube boilers made by the Heine Safety Boiler Co., St. Louis, Mo., which have a capacity of 400 H. P. each. They are of the regular Heine double shell type with a furnace 9 ft. in width. The boilers are set in two batteries of five boilers each thus economizing very materially in amount of brick work required in the setting and in the floor space required, thus making a smaller boiler house impossible than would otherwise have been the case. It was originally the intention to provide the boilers with hand-fired grates, but just prior to their installation, it was determined to use mechanical stokers of the underfeed type. Also provided are Cochrane feed-water heaters; air compressors, and a condensing system is also later to be installed, which will materially increase the horse-power of the plant.

The company maintains a complete repair department to take care of any breakdowns that may occur in any part of the plant, and in its large supply-house repair parts to the value of \$75,000 are always kept on hand, and in nearly every case a duplicate is available, thus avoiding long and troublesome delays and shutdowns. The machine shop is thoroughly equipped for all work required of it. Its equipment includes machine tools of sufficient variety to do all kinds of work on castings, it being the policy of the company to purchase all



Plan showing general scheme of power distribution.

ing the beginning of the wet process. Pipes convey this mixture to 10 slurry tanks, where it is thoroughly agitated and mixed into what is known in this process as slurry. This is the end of the raw finishing end, and the

necessary castings in the rough and machine them down at the plant. Carpenter, blacksmith and bag repairing and cleaning shops are also maintained.

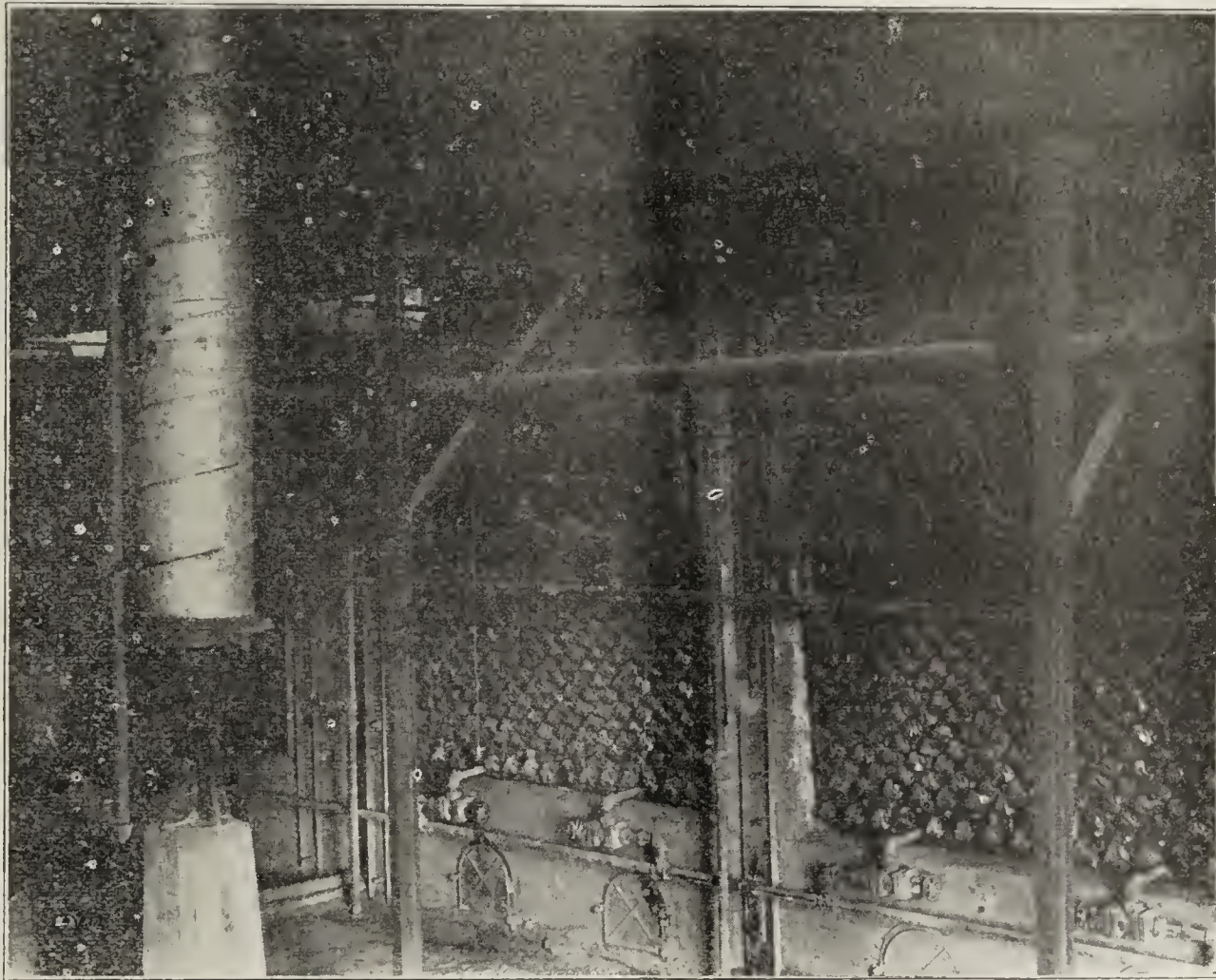
Vast quantities of water are consumed at the plant, running anywhere from 300,000 to 500,000 gallons daily, and this is secured from two sources, coming from the mountains during the winter months and from the Tennessee river during the summer months. The water from the mountain has been secured by the construction of a reinforced concrete dam 40 feet long, thus making a large reservoir of splendid water, which is also used for all drinking and domestic

modernly-equipped school is to be erected which will give the children a good fundamental education, and the company insists that all of the children of employes, both black and white, living within the city limits shall attend school. A sanitary squad is also employed whose duties are to see that the houses and yards of the householders as well as the plant is always kept clean, and since the first-construction work was started here there has been no serious sickness on the part of any employes and no contagious diseases whatever.

The general store on the property is not owned by the company, and it has no interest in running it whatever

in building the plant to safeguard the employes from accidents, and at the same time the writer was going through the plant the representative of the insurance company was inspecting these safeguards, and he stated after completing his investigation that the plant was splendidly equipped in this respect.

The splendid manner in which the topography of the land has lent itself to the ideal arrangement of the various buildings in relation to the raw material deposits can be noted in the accompanying illustrations. In the two broadside views of the plant the course of the material from start to finish can be readily noted, as in suc-



Heine safety boilers in the Dixie Portland cement plant. There are ten Heine boilers of 400 H. P. each.

purposes by the town. The summer supply from the Tennessee river is forced through a 12-inch pipe line by the company's own pumping station located near the river, about one mile away.

The company has erected a number of prettily-designed cement dwellings for its employes, and these will be constantly added to as required. They are all equipped with modern conveniences. There are also a number of smaller dwellings for the negro laborers, who form the largest part of the unskilled hands, and in the endeavor to secure the best of this labor that was possible the company has erected a negro school and church and placed in charge of both a negro preacher. Schools are also provided for the children of the white employes, and in the near future a

except making the restriction that at all times first-class goods must be sold at reasonable prices. Thus it will be seen that the company takes a deep interest in the welfare and comfort of its employes, and this interest extends also in their work, and a noteworthy feature of the plant which so impressed the writer was the intense interest manifested by the men in their work. The plant runs continuously day and night, and so earnest are the men in their work that one shift vies with another to see which can turn out the largest and best product. Indeed, this is the spirit which seems to permeate the whole organization, and it is of the kind that makes in the largest measure for real and lasting success in any industrial enterprise.

Every precaution has been taken

cession can be seen the quarry, rock crusher, raw material buildings, kilns, finishing department buildings and storage warehouse and shipping department. In each of the three views of the plant the effect of the limestone dust is noted, and this has made a perfectly clear photograph impossible. This dust, however, is not to be constant, as the company is planning an arrangement to prevent it from rising. In the view taken from the quarry and looking down on the plant a splendid idea of the compactness of the plant is obtainable. The illustration of the limestone quarry shows the face as opened at present for one-quarter of a mile, but, as previously pointed out, this is to be gradually widened to one-half mile on either side of the entrance to the big crusher platform. The

big steam shovel can be seen at work loading the rock on the dump cars. These are not the cars which will be regularly used in the quarry work, the company having purchased some of a more improved type, to which reference was previously made.

Taken altogether, the different illustrations give a very comprehensive idea of this big plant, and the excellent manner in which it has been laid out.

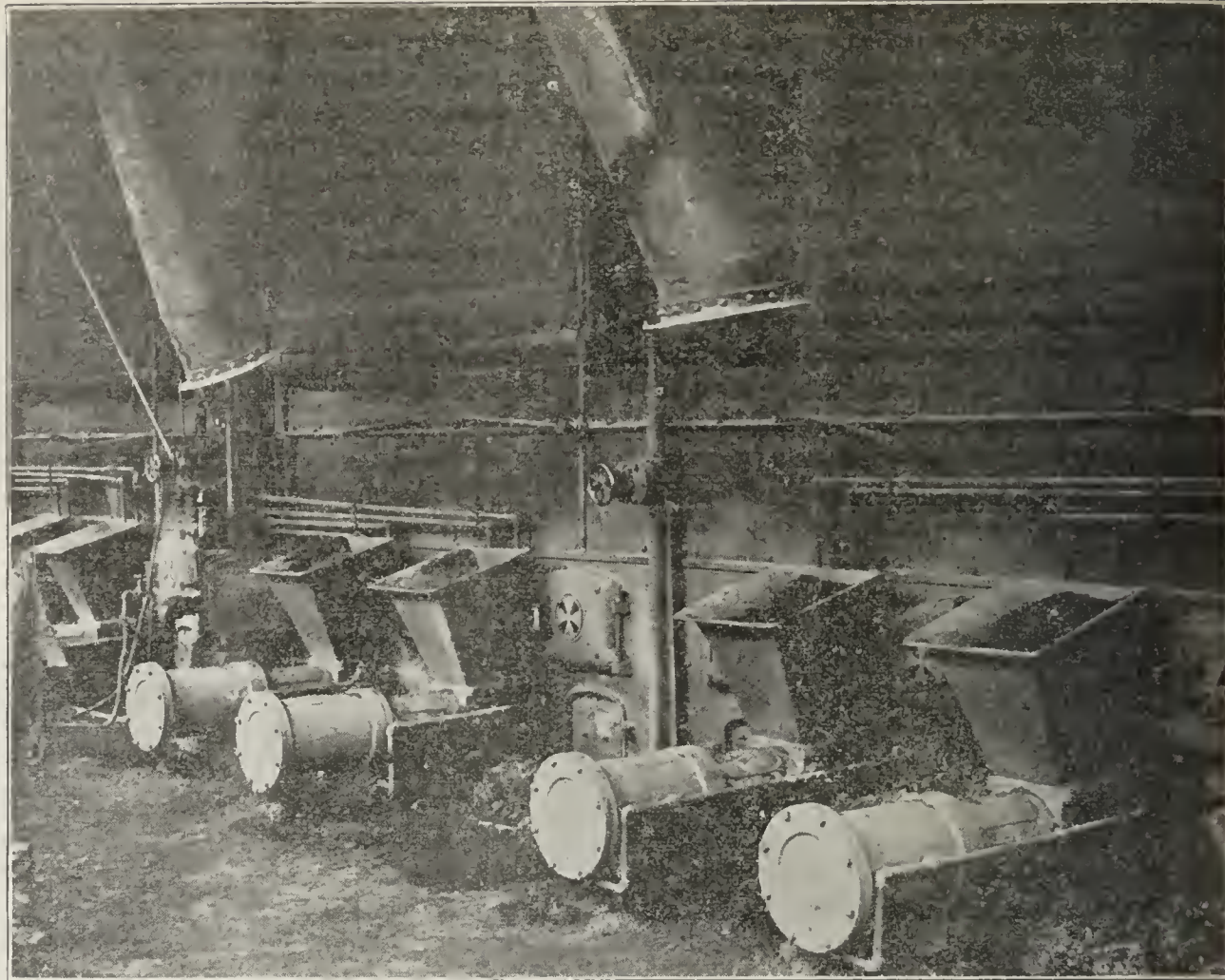
The officers of the company are: President, George E. Nicholson, Iola, Kans.; vice-president, A. B. Cockerill; treasurer, L. L. Northrup, Iola, Kans.; secretary, Richard Hardy, Richard City, Tenn.; superintendent, Ellis C. Soper; chief chemist, W. H. Kewish.

All of the company's products will be handled through its sales managers, H. C. Koch, with offices in the James Building, Chattanooga, Tenn., and in order to get in closer touch with the trade numerous distributing agencies have been established in many parts of the South.

CEMENT FINISH STREET PAVING.

The Rudolph S. Blome Company's latest catalogue is just out and all those interested in Granitoid Concrete Blocked Pavement should have a copy of this booklet which is one of the handsomest of its kind ever published. It contains fine photographs of their pavement laid in many of the leading cities of the country.

The following is what they have to say regarding this pavement: "Which Pavement Shall We Select? This, without doubt, is one of the most serious problems confronting the authorities and owners of property of practically every municipality. This is the age of concrete; therefore, why not a concrete street pavement? It has remained for one of the old pioneer firms of concrete contractors to successfully demonstrate the adaptability of concrete for street paving purposes, and this is rather fortunate, inasmuch as a result of many years of varied experience in all forms of concrete construction many obstacles were encountered which could only be corrected by a firm long experienced in all branches of concrete work. We have for many years been of the opinion that such a pavement would and should prove practicable, durable and of superior wearing qualities, and during the past ten or twelve years we have made many experiments in the direction of producing a concrete pavement that would verify our belief, and we are now amply prepared to convincingly demonstrate that the Blome Com-



View of boilers installed in new plant of the Dixie Portland cement company, manufactured by Heine Safety Boiler Company, St. Louis, Mo.

pany Granitoid Concrete Blocked Pavement not only possesses many advantages over the so-called permanent pavements now in use, but in addition thereto eliminates practically all of the objectionable features. While a great many various kinds of pavements have been laid, many of them have proven to be unsatisfactory and unsuitable for the intended purpose. Some have been found too expensive, not only in view of first cost, but because of the necessity of frequent repairs; another pavement may prove too noisy, another too slippery, certain block pavements crumble and develop settlements, which cause them to become unsightly, unsanitary and unfit for traffic, while composition sheet pavements have proven unsuitable because the life of the aggregate thereof is of but short duration. The Blome Company Granitoid Concrete Blocked Pavement is intended for traffic from the lightest to the very heaviest, and we are prepared to demonstrate that the pavements laid by us during the past ten years, many of which have been subjected to incessant trucking of the heaviest kind, today show less wear than any other form of pavement put to a similar test. By making a study of the construction of our form of pavement, it will be at once seen that the monolithic feature of same entirely eliminates settlement of any kind, as any soft or unstable spots are bridged over

by the concrete, while at the same time defects caused by expansion are fully guarded against, as liberal expansion joints are provided at regular intervals and also between the pavement and curbs, and these joints filled with a special composition filler. A great deal of experimental work was necessary before it was possible to obtain the proper kind of filler, one that would take care of both expansion and contraction in the work, but ours is considered perfect in this regard wherever it has been installed. The surface blocking of the pavement consists of a special crushed granite mixtures which, when completed, leaves the pavement extremely sanitary, fairly smooth, yet not slippery, and pleasing in appearance. Our pavement has been successfully adopted and laid on grades as high as 7 per cent, and on account of the quality of crushed granite used in the surfacing of the blocking, it is not found slippery for horses, and automobiles will not skid on same. Brick and granite block pavements being laid upon a sand cushion which separates the foundation from the wearing surface, develop an excessive amount of noise, which is prevented by the monolithic form of our construction: our pavement is therefore less noisy than either of these and no noisier than asphalt or other forms of sheet pavement. Our pavement is the only one in which

sections can be cut out and replaced at exactly the same level as the adjoining pavement; same is not affected by the elements, will successfully stand continual usage in the warmest and coldest climates and statistics will prove that concrete hardens with age, whereas all other forms of pavements deteriorate under the action of the elements. There is scarcely a city in the United States that has not experienced more or less trouble endeavoring to procure a pavement that will prove successful along and between street car tracks.

We believe our pavement to be the most desirable one for this purpose as it is possible to lay in an extremely neat manner along the rails, there being no opportunity for the flanges of the wheels crumbling or disintegrating the edges of the pavement. A large number of the heaviest type of electric cars pass constantly over our pavement at various locations, which proves that the selection of our type of pavement for electric railroad work is not only the best but practically proves same to be the only one which can be successfully used, as it is absolutely unaffected by the jar caused by the moving of trains or the elements of the weather.

An excellent example is the paving work between the car tracks at Washington for the Washington, Alexandria and Mt. Vernon Railway Company and also the work for the Houghton County Street Railway Company at Houghton, Michigan.

Under the most severe usage our brick, granite block and all forms and as a consequence during wet weather it is far less slippery than brick, granite block and all forms of sheet pavements. Traffic over a newly constructed street pavement can be permitted equally as soon as over any form of sheet or block pavement, as the concrete portion of any work started upon during any day, is entirely completed during the same day and is ready for traffic in about one week from the time the laying of the concrete is started; whereas, in the laying of the concrete is started; whereas, in the laying of the concrete base for other pavements, a week at least usually elapses for the concrete to dry before the surfacing or blocking can be put in place, therefore it will be readily seen that our form of paving can be turned over for traffic more quickly than any other form of paving on a concrete foundation.

We believe it advisable for every

city contemplating paving to endeavor to employ as much home labor and utilize local material as far as possible, with the idea of keeping the money spent for such improvements in the city or town where the improvement is made.

In the case of most block and sheet pavements, the material entering in the construction of same is manufactured at a distant point and heavy freights must be added for the furnished material which is utilized in the construction of the work and local labor enjoys very little benefit as far as the construction is concerned, whereas in the laying of our pavement, local labor is utilized almost entirely, and in a great many instances the cost of freight is reduced to a minimum for the reason that so much local material can be used.

Our work can be readily inspected as it progresses, and in case it is ever necessary to cut through same, the plant required for replacing the damaged work is not extensive and these repairs can be readily made upon the formula and ingredients furnished by us at all times for this purpose.

An ordinary rain will cause any dirt carried on our pavement to quickly shed toward the gutter from where it can be easily and cheaply removed. We can refer to locations where our paving is laid where it will be found that the cost of keeping our pavement in a clean and sanitary condition is less than one-half of the cost of cleaning other forms of pavement. This is a matter which we think is deserving of great consideration, inasmuch as no pavement can be considered beautiful which is not sanitary and clean at all times, and we feel that the further the sanitary feature of our pavement is investigated, the more popular it is bound to become.

The joints of all forms of block pavements will hold a certain amount of dirt; sheet pavements in warm weather become soft and cannot be cleaned thoroughly without being broomed. Our kind of pavement absorbs no dirt, neither along the joints nor in the surfacing, and we believe that with a slight investigation any competent judge will admit that our type of paving is the most sanitary of all forms of pavements.

Our pavement is fully guaranteed. It was selected after a thorough investigation by the United States Government for the continuation of Fourteenth Street in Washington.

Before the officials of the United

States Steel Corporation adopted our form of pavement for the principal streets of the new model town of Gary, Indiana, they thoroughly investigated all types of permanent pavements, and as a result they became strongly convinced of the merits of our type of paving, and it was adopted forthwith.

The prominent firm of Armour & Co., and other packers, adopted our kind of pavement on Packers Avenue, the main thoroughfare through the Union Stock Yards at Chicago. Our pavement was also adopted by The Western Electric Company, on a number of streets surrounding their plants in Chicago and Atlanta, Georgia; also by the West Park Commissioners, the city of Hancock, for their residence and business streets, and the city of Kalamazoo, Michigan. During the last year a committee of city officials of Grand Forks, North Dakota, headed by Hon. George E. Duis, mayor, was sent by the city of Grand Forks at its expense for an extended trip, visiting St. Paul, Minneapolis, Duluth, Chicago, St. Louis, Boston and other centers for the purpose of ascertaining the most desirable form of paving for their city. As a result of the council upon their return that the entire committee favored the Blome Company Granitoid Concrete Blocked Pavement. Our pavement was the only one meeting all the essential requirements, being durable, sanitary, desirable for both light and heavy traffic, pleasing in appearance and one that can be easily relaid, etc. Their full report will be cheerfully sent upon request and we have reports of other similar committees on file and would be pleased to forward same to any officials or citizens who may be interested in contemplated paving.

The pioneer firm of Rudolph S. Blome Company, of Chicago, has been known for many years all over the United States as contractors for concrete work of every description. It has executed heavy contracts in nearly all the large cities of the United States, the firm being established in 1866, and we believe as to reputation, there is no concern of higher standing, as to the fulfilling of its contracts, etc. Before it was decided to lay our form of pavement in the large quantities now being installed, many years were devoted in order to ascertain just the kind of paving necessary, to take care of the various kinds of traffic and as a final result of our thorough experiments, we believe that the type of paving as now constructed by us will outlast any type of manu-

factured paving on the market at this time. We can refer to localities where our pavement is laid adjoining other types and it will be found that ours is the favorite of all."

SAN ANTONIO PORTLAND CEMENT COMPANY.

Contracts have been signed by the Henry S. Spackman Engineering Co., of Philadelphia, Pa., and the San Antonio Portland Cement Company for the erection of a Portland cement plant near San Antonio just north of Alamo Heights on the line of the International and Great Northern Railway where the company have a 30 acre site. A town to be known as Cementville will be built. The plant will have a capacity of 1,000 barrels per day. Construction will begin on the plant October 1. C. Baumberger, of San Antonio, is president of the company, F. W. Cook, vice president. The plant will cost \$500,000.00 and be in running order October 1, 1909.

The Cement Securities Company, of Denver, Colorado, have appointed F. L. Smidth & Company, 41 Cortland St., New York, their Consulting Engineers.

The Securities Company controls Portland, Colorado and Devils Slide, Utah, and under construction at Three Forks, Montana, and El Paso, Texas.

We are in receipt of a handsome new catalogue from the Vulcan Iron Works, Wilkes-Barre, Pa., which contains fine half-tones of their cement making machinery such as rotary kilns, dryers, coolers, etc. This is one of the finest catalogues ever published and should be in the hands of everyone interested in cement making machinery.

On Sept. 11, a number of the buildings of the Kosmos Portland Cement Co., at Kosmosdale, Ky., were injured by a fire which was probably due to the ignition by an electric spark of powdered coal, used in the rotary kilns. The company's fire-protection system proved able in previous fires to prevent the spread of the flames, but the explosive nature of a coal-dust fire made the initial area of conflagration too great for the local facilities to control effectively.

The Kenosha, Wis., cement sidewalk contractors have refused to bid on city sidewalk work. The city is therefore compelled to organize a force to lay its own sidewalks. Mr. Charles Sternbock, superintendent

of streets, is a practical cement sidewalk man and will take charge of all future work in this line.

The stockholders of the Crescent Portland Cement Company have authorized the issue of \$200,000.00 bonds to be used in completing the new plant at Wampun, Pa. The works are to be completed by January 1, 1909.

EDISON'S CONCRETE HOUSE.

While on a short visit to Spokane, Wash., in describing his moulds, Mr. Edison said a set of moulds for a two flat dwelling will weigh 400,000 pounds and will cost \$25,000, while the other apparatus will probably cost \$15,000. Only a builder with large capital can purchase the outfit. The moulds will be sufficiently flexible to avoid a dead monotony of style. The cost of a single set of moulds and apparatus is to be spread over 1,500 houses and thus reduce the cost of the use on each individual structure to a nominal sum.

An important step in the development of engineering chemistry in this country was taken at the recent New Haven meeting of the American Chemical Society by the organization of a Division of Industrial Chemists and Chemical Engineers. Arthur D. Little, of Boston, was elected chairman of the Division and Vice President of the Society, and indicated in his address the broad field awaiting development by the new organization.

The Division will include a large proportion of the membership of the Society and especially those engineering chemists whose work is directly concerned with industrial development and progress. The Division will begin the publication at an early day of The Journal of Industrial and Engineering Chemistry, for which a strong board of editors was elected.

The Laconia Car Company (Laconia, N. H.), has closed contract with the Aberthaw Construction Company of Boston for the erection of cabinet shop and storage building. It is proposed to build the cabinet shop with concrete walls and mill construction floors. The storage building is fireproof. The work involves the removal of two of the existing wooden buildings to make room for the new obstruction. The work is to be pushed rapidly in order to give the increased output necessary for the car company's business.

The Aberthaw Construction Co.,

of Boston, Mass., has just been awarded the general contract for the erection of a six story store and office building of reinforced concrete for Ex-Mayor J. P. Baxter, at Portland, Mo. This contract is a direct result of the general interest in the matter of fire proof construction which has been aroused by the disastrous fires which have recently visited the city. So far as known the only other reinforced concrete building as yet erected in the city is the six story warehouse built three years ago by the Aberthaw Co. for the Portland Saving Bank.

The Superior Portland Cement Company's plant at Superior, Washington made the first shipment of cement on August 7 to Grinshaw, Caine & Co., of Seattle, Washington. The mill started up with a capacity of 500 barrels per day which is to increase to an ultimate capacity of 1,800 barrels per day.

HIDALGO PORTLAND CEMENT CO.

F. F. Niggli, general manager of the Compania Cementos Hidalgo, S. A., whose plant is located at San Nicolas, Hidalgo, in the State of Neuvo Leon, says: "We are now producing the highest grade of Portland cement that possesses all of the required tests. The plant is equipped with the most modern up-to-date machinery to be found anywhere in the cement industry, high grade experts being in charge of every department. All cement shipped is guaranteed to our customers. The Mexican government and the State governments of Nuevo Leon and Chihuahua, as well as the city of Monterey are taking our cement in large quantities in repeated orders. The mining companies in our vicinity, architects and contractors are using our product with entire satisfaction.

Maurice Holloran, who has tried to induce the Decorah, Iowa commercial club to take stock in a proposed cement plant project and failed, has not given up hope. He has purchased a rock crusher and a pulverizer. With this machinery, Mr. Holloran will start to make cement on a small scale in an upright kiln. If this product is good, he expects to influence capitalists to start a large plant.

The Hunt Engineering Company, of Iola, Kansas, who built the Ash Grove Lime and Portland Cement Company at Chanute, Kansas, has turned the plant over to the cement company after operating the same

for two months as required under the contract for constructing the same.

The U. S. Cement Company at Bedford, Ind., resumed operations on September 1 after being shut down for two months.

The West Coast Portland Cement Company has commenced building operations at its site on the Snake River near Lewiston, Idaho. J. M. Edwards, assistant treasurer of the company, says the 100 barrel daily capacity of the proposed plant has been sold in advance. The works are to be completed by January 1, 1909. The capacity of the plant will be increased to meet future demands.

The cement companies in the west are to unite in an organization similar to that of the North American Cement Company with headquarters in Detroit or Chicago. There will be no merger of individual plants, nor will prices be increased under proposed organization.

The Pennsylvania Railroad is continuing its test of reinforced concrete telegraph poles at the most exposed points of its system west of the Allegheny Mountains. The severe weather during the coming winter months will give the poles a fair trial.

Promoters are at work to organize a cement company to locate a plant near Moran, Allen county, Kansas. Options were taken on the Aber farm west of Moran. Mr. M. A. Hapgood, of Moran, is one of the interested parties.

The Piedmont Portland Cement and Lime Company which controls lime stone and shale deposits in Polk county, Georgia gave an excursion to some 400 stockholders from Atlanta and intermediate points to the site of its proposed plant where the annual stockholders meeting was held and all of the old officers were re-elected.

The promoters of the Judson Portland Cement project at Judson, Blue Earth county, Minnesota, are not receiving the encouragement they expect from the people in the vicinity. They say it may be a good thing but refuse financial aid.

CONCRETE VS. STEEL BRIDGES.

The subject of concrete against steel bridge construction is a live question at this time in Spokane, Wash., the common council of that

city having passed an ordinance for the construction of a steel bridge over the Spokane River. The merchants, property owners, real estate board and the newspapers are all asking for the repeal of the steel bridge ordinance and the substitution of concrete material for this bridge.

The Spokane Review makes this argument in favor of concrete bridges: If Spokane builds a \$1,000,000.00 steel bridge, \$800,000.00 of this sum will go to eastern manufacturers and to railroads for freight, while if the city spends \$1,000,000.00 for a concrete bridge, \$800,000.00 of the money will be kept at home. The day of steel bridges is rapidly passing in favor of reinforced concrete. While a concrete bridge will cost slightly more than a steel bridge at Spokane, the difference in price will soon be made up in repairs. Therefore give us a concrete bridge that will be permanent and eliminate annual repairs, while the life of a steel bridge depends upon the constant care given it to keep it in order.

The Lake Shore Portland Cement Co., of Sandusky, Ohio., will build a plant at Sandusky, Ohio, at a point on the northwest suburbs of that city near the intersection of the Lake Shore & Michigan Southern, Pennsylvania Big Four & the Lake Erie & Western Railways. 40 acres of mail lands have been leased near Costalia on the South shore of Sandusky Bay. The Buckeye Realty Co. has contracted to erect the company's plant. The buildings of the Toledo Portland Cement Co. at Manchester, Mich., are to be torn down and re-elected at Sandusky, by the Republican Structural Iron Co., of Cleveland, Ohio, who have the sub-contract for this work.

Mr. W. E. Wood, president of the Lumbermans' Portland Cement Co., which is to build a plant at Carlyle, Allen county, Kansas, says he expects to commence building operations some time in September, after the plans are all in shape. The late panic upset the company's financial plans.

THE NEXT CHICAGO CEMENT SHOW.

February 18th to 24th.

The Cement Products Exhibition Company will hold its second annual cement show at the Chicago Coliseum from and including February 18 to 24. This date was fixed upon after consulting practically all of the exhibitors having space at the First Annual Cement Show and others interested in the production

and use of cement and the education of the general public to its use.

Application for space will be received and entered on the company's books in advance before the actual diagrams of the floor space have been prepared.

For the forthcoming show unusually elaborate and comprehensive preparations are being made to interest not only those directly connected with the cement trade, but the general public as well. The future of the industry depends to a very large extent upon public opinion, and not until people generally can be educated to favor and use concrete over other forms of building material, will the cement industry occupy the place which it should properly hold.

The underlying idea of the Chicago Cement Show is to teach those who know something about cement construction more, and to teach those who know nothing about cement something. A cement show should not be conducted entirely for the purpose of bringing direct business to the exhibitors, but it should be an industrial demonstration that will create universal interest in cement and its innumerable uses.

Chas. L. Johnson, general sales agent of the Castalia Portland Cement Company, says the Castalia mill is far behind orders booked with new orders being constantly received.

The Northwestern States Portland Cement Company, of Mason City, Iowa, has secured an order of 1,500 barrels of cement to be used in the construction of a concrete dam on the Wapsipipicom River at Independence, Iowa.

The Acme Portland Cement Company which has been incorporated under the laws of the State of Washington, was organized by Aman Moore, of Los Angeles, Cal. The company propose to build a plant at Lake Pend, Orielle, Kootenai County, Idaho. The following prominent capitalists are identified in the enterprise: F. H. Mason, R. K. Neil, John W. Graham, C. K. Culbertson, A. L. Wright, Jerome Drumheller, Dr. J. Sutherland, C. M. Fassett, J. W. Hadley and E. C. Hadley. The company plans to erect a \$700,000 cement plant. Its capital stock is \$2,500,000, divided into 25,000 shares of \$100 each, of which 3,000 shares are preferred and the rest common stock. The preferred stock bears 7 per cent interest.

The citizens of Spokane have taken \$75,000 of the company's stock to date. The company have 1,500 acres of land on Lake Pend Orielle which carries all the raw cement materials required for the manufacture of a high grade Portland cement.

The Havana Cement Products Company has been incorporated under the laws of Delaware; capital, \$350,000. The incorporators are F. M. Shine, S. E. Roberson, Harry W. Davis, of Wilmington, Del.

Sept. 21, 1908.

Editor Cement and Engineering News, Chicago, Ill.

Dear Sir: We take pleasure in informing you that the American Cement Engineering Company, 315 Fifth Avenue, New York, has entered into contracts under the terms of which it will construct for the Knickerbocker Portland Cement Company two cement plants on the Hudson River with a combined daily capacity of 12,000 barrels, and an annual output of not less than 4,000,000 barrels of Portland cement.

Work will start almost immediately on the rebuilding of the 2,000 barrel plant at Hudson, on the east bank of the river. Its daily capacity will be raised to 6,000 barrels, and the work will be pushed rapidly to completion. The Engineering Company promise to have the plant ready to reach a production at the rate of 2,000,000 barrels annually, late next spring.

The plant on the west bank, near Catskill, will have construction started early next year, and will be completed and in operation about a year from the date the foundations are started.

Both contracts provide for machinery of the highest efficiency and factory construction generally of the most solid type. From an electrical standpoint these plants will mark the advances made in recent years in that science.

The Knickerbocker Portland Cement Company has acquired about 1,400 acres of high grade limestone, shale and clay lands on the east bank of the river, and more than 500 acres of equally valuable lands on the west bank, with ample railway and water shipping facilities on both properties.

Yours very truly,

American Cement Engineering Company,

By Clayton C. Cooper.

The Speeds Portland Cement Company in Jefferson County, Ind., ran short of its ordinary water sup-

ply, due to the lack of rain. A deep hole in the bed of Silver Creek was found full of water. About a mile of pipe line was run from the mill to this water, saving a shut-down of the plant. Many other plants in Ohio, Indiana and Kentucky have been compelled to shut down on account of the failure of the water supply.

Sir William Van Horn, late of the Canadian Pacific Railway, has organized a cement company which will erect a plant in Cuba.

Col. James Donohue, of Colfax, Jasper County, Iowa, has given a contract to the Tri-City Construction Company, of Davenport, Iowa, for the construction of a concrete hotel to be erected at Colfax, Iowa, to cost \$125,000.

The West Coast Portland Cement Company is erecting a small 100 barrel Portland cement plant on the Snake River, near Lewiston, Idaho. Mr. J. M. Edwards, assistant treasurer of the company, says the plant is to be completed by Jan. 1, 1909. The output of the proposed plant has been largely oversold. The mill will be increased to 1,000 barrels per day when the demands justify the increased capacity.

The Lehigh district cement mills are full of orders. The outlook for the fall trade is excellent.

Henry Berthelet, of the Milwaukee Cement Company, died on Sunday, Sept. 20. Mr. Berthelet has been identified with the Milwaukee Cement Company for over twenty years.

The Oklahoma gypsum industry is facing a problem of securing cheap fuel. Coal which is now used is expensive. The sharp competition will soon compel the use of cheaper fuel. The unlimited natural gas supply in the eastern part of the state controlled by the Chactaw Indian Nation will either have to be piped to the gypsum fields or the gypsum industry will have to be abandoned. The Oklahoma Portland cement industry being located in the coal and gas fields are not hampered for cheap fuel.

W. E. Owens, of the Nebraska Concrete Reinforcing Company, of Omaha, has invented a water proofing compound.

The Heber Concrete Construction Company was organized in Heber, Arkansas; capital stock \$5,000. Following are the officers of the com-

pany: J. C. Copeland, president; W. J. Short, vice president and general manager; J. G. McDaniel, secretary; B. Burns, treasurer; all of Heber.

We are in receipt of a handsome new catalogue from the Vulcan Iron Works, Wilkes-Barre, Pa., which contains fine halftones of their cement making machinery, such as rotary kilns, dryers, coolers, etc. This is one of the finest catalogues ever published and should be in the hands of every one interested in cement making machinery.

This will be a banner year in the Portland cement export trade. The two contracts of the Atlas Portland Cement Company with the United States government for cement for the Panama canal call for 4,580,000 barrels, while the 1,000,000 barrels sold by the Bath Portland Cement Company to the city of Havana bring the export figures up to 5,480,000 barrels alone. We have not imported this amount of cement in any one year during the past ten years.

The Brior Iron Coal Company's slag cement mill at Youngstown, Ohio, caught fire on Sept. 8 and destroyed the cement storage bins. The fire originated in these bins from spontaneous combustion. The injury to the other portions of the mill was small.

"The Sandusky Portland Cement Co., Sandusky, Ohio, is furnishing several tons of water-proof compound which is being used in connection with Portland cement for lining a shaft being sunk from the top of a hill into a Railway tunnel at Wilkes-barre, Pa. The work is being done by R. D. Isaacs & Son, Contractors, at that place.

It will be understood by parties who are interested in water-proofing various cement construction that an air shaft of this kind must have a water-proof lining; otherwise the surface and drainage water from the hill would cause the tunnel, at all times, to be wet.

The same Company furnished their Medusa white Portland cement for the Government Rifle Ranges recently finished at Camp Perry, Ohio, which construction was done by the R. H. Aiken Engineering Co."

Also for the new Senate Office building at Washington, D. C.

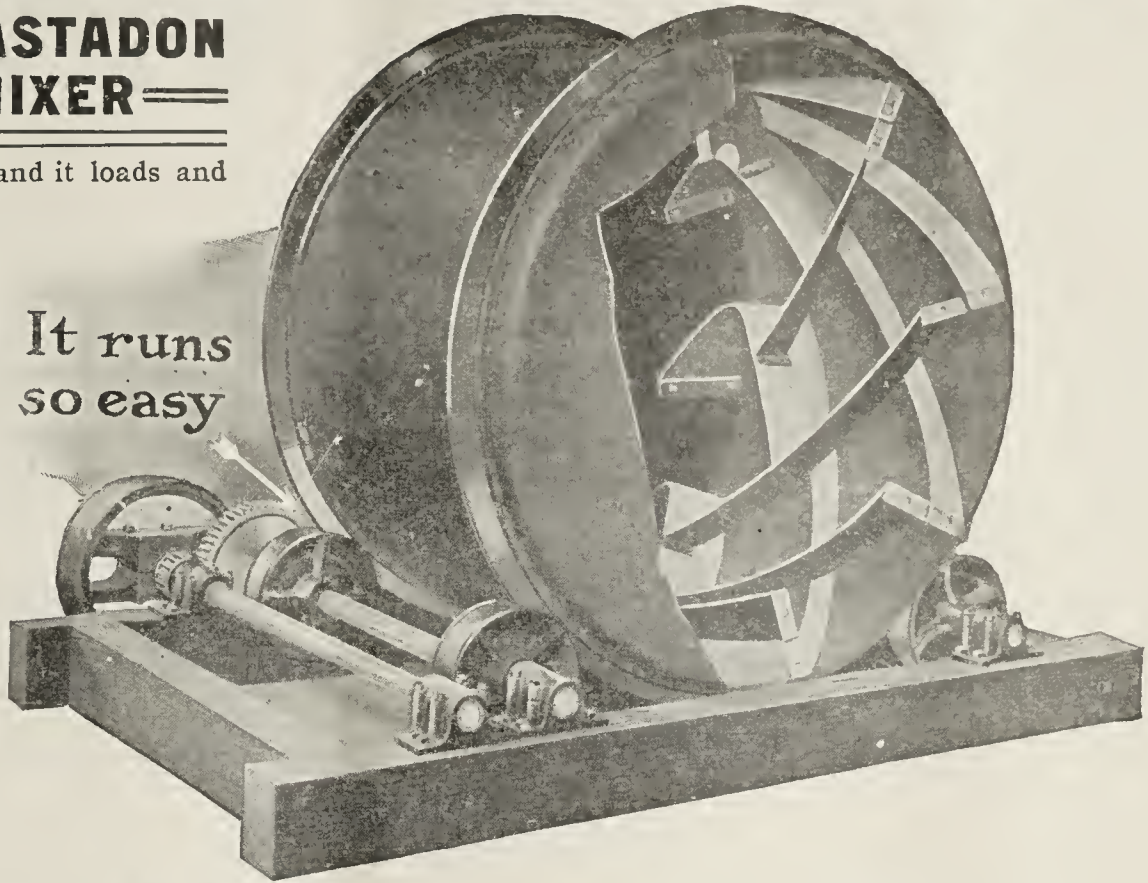
Mr. Edward Koch of Sandusky, Ohio has recently joined the Sales Organization of the Pittsburg office of the Universal Portland Cement Co.

SAVE POWER AND YOU SAVE \$ \$ \$ \$ \$

The MIRACLE MASTADON CONCRETE MIXER

Mixes thoroughly and rapidly and it loads and unloads quickly--all this is easy to demonstrate--easy to prove. But, now how is the power applied? The cylinder has no cogs, being revolved by the flange, which rests on grooved friction rollers. By actual test as well as in correct mechanical theory this friction revolving device requires very much less power than is needed to run any other mixer of equal capacity. One gear, which is covered and easily kept free from sand and dirt, runs the machine.

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Just off the press, worth your while to
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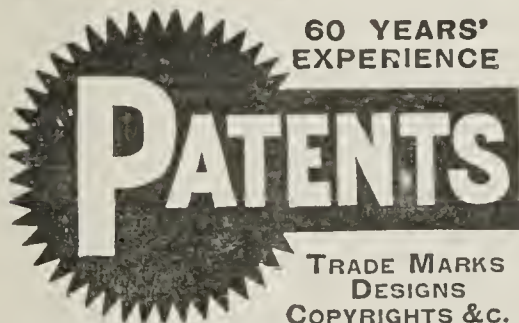
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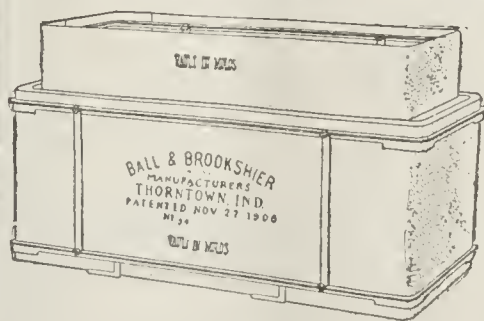
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The U. S. Government is spending millions of dollars in getting a permanent water supply for a million acres of arid land.

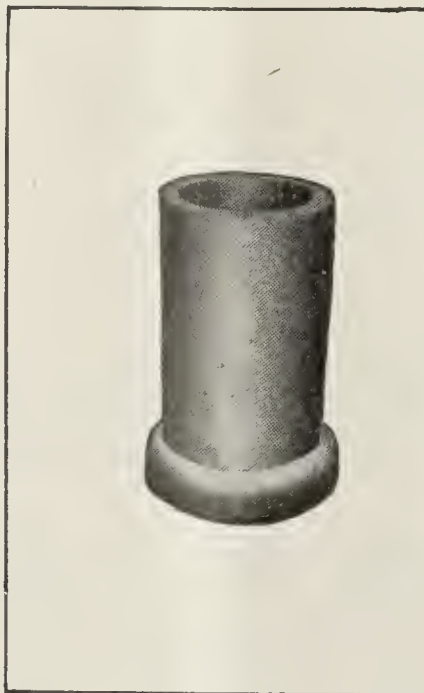
Go and see for yourself. Rates to Albuquerque

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Attractive side-trips to Reclamation projects and Grand Canyon of Arizona.

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YOUR HARVEST SEASON IS SOON TO OPEN.

Are you equipped to get all the profitable business in your line? Take sewer pipe. \$34.50 will equip you with a 15" bell and pipe mold. This size is mostly used by road supervisors for culvert work. The profits on one hundred foot of his pipe sold at clay prices will pay for a mold. This is certainly worth investigating. Had you not better send your order for a 15" size today?

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PAUL O. COOK, Proprietor

Clarinda, Iowa, Dec. 17, 1906.

Miracle Pressed Stone Co., Minneapolis.

Gents:—The tile molds I find to be just the thing. We had a good sale of the tile, it was late in the year to buy these tile molds but we had a good trade. We made about 3000 ft. of 12 in. tile; 2500 ft. of 15 in. tile; and about 1500 ft. of 25 in. tile. I think they are better than clay tile. They will stand frost better, and the older they get the better they are. A clay tile is no better than the day it is put in the ground—cement gets better the longer it is in the ground. I know this to be true; I have made clay tile for 16 years and am still making them.

Yours PAUL O. COOK.

Miracle Pressed Stone Co.,
 Largest Manufacturers of Concrete Machinery in the World
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PERFECTION IN BLOCK MAKING

If you wish to attain this you should combine these three important features:

**WET PROCESS FACE DOWN
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The **PETTYJOHN INVINCIBLE MACHINE** does this, and is the only machine that does. Tandem Invincible makes two blocks at once. Price, \$65 and up. Single Invincible, \$35 and up. With our **Triple Tier Racking System** green blocks can be stacked three high direct from the machine with inexpensive home made rigging. Plans and blue prints free to customers. It economizes space, reduces off-bearing distance and above all insures slow, even, damp and perfect curing and bleaching.

Write for our latest edition of "Stone Making," a book of valuable data, just off the press.—Free.

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Daily Output 17,000 Barrels
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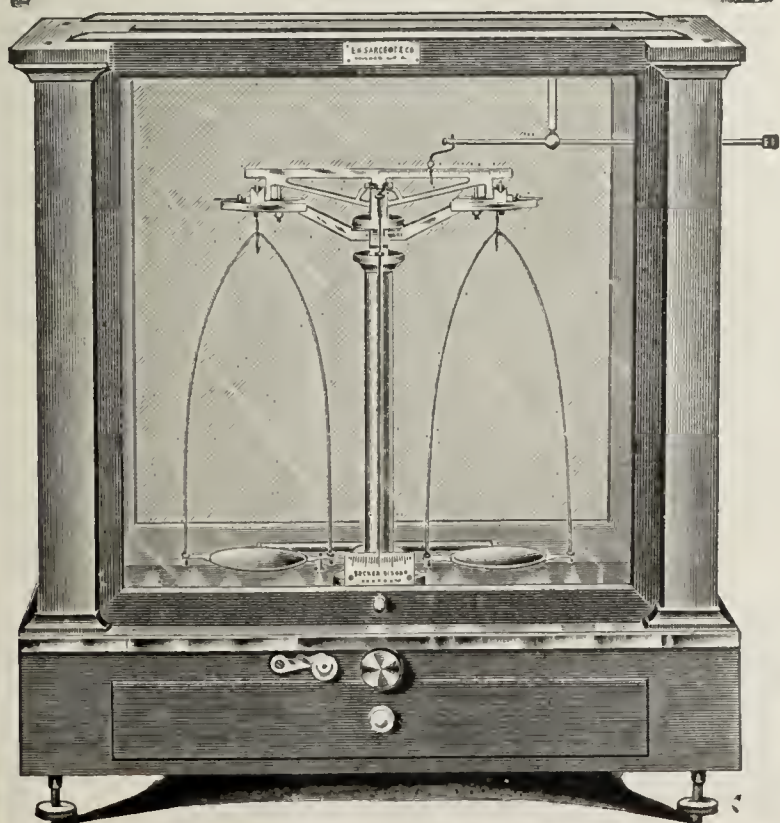
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Perfect Mixed Concrete and Durability

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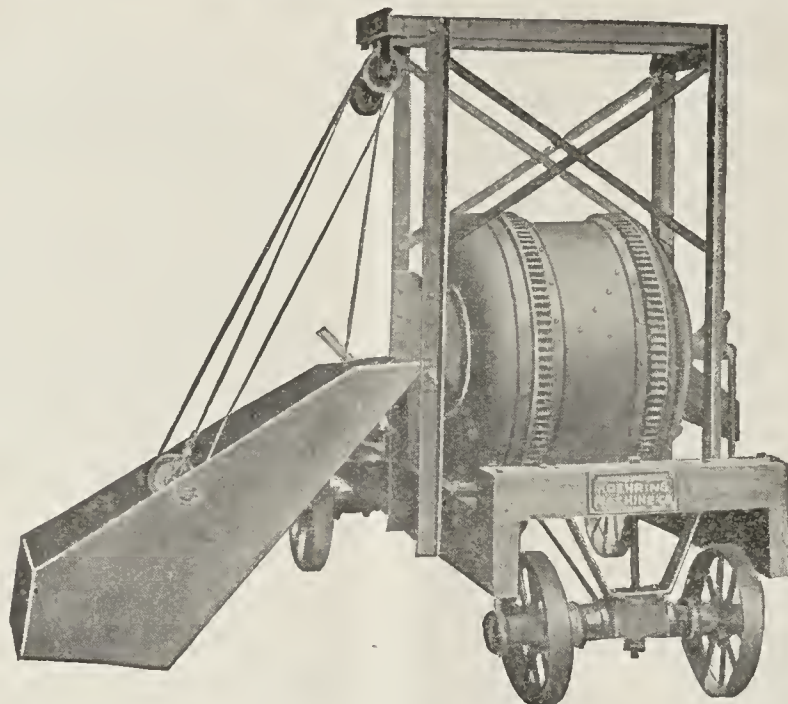
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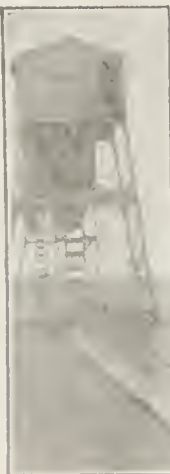
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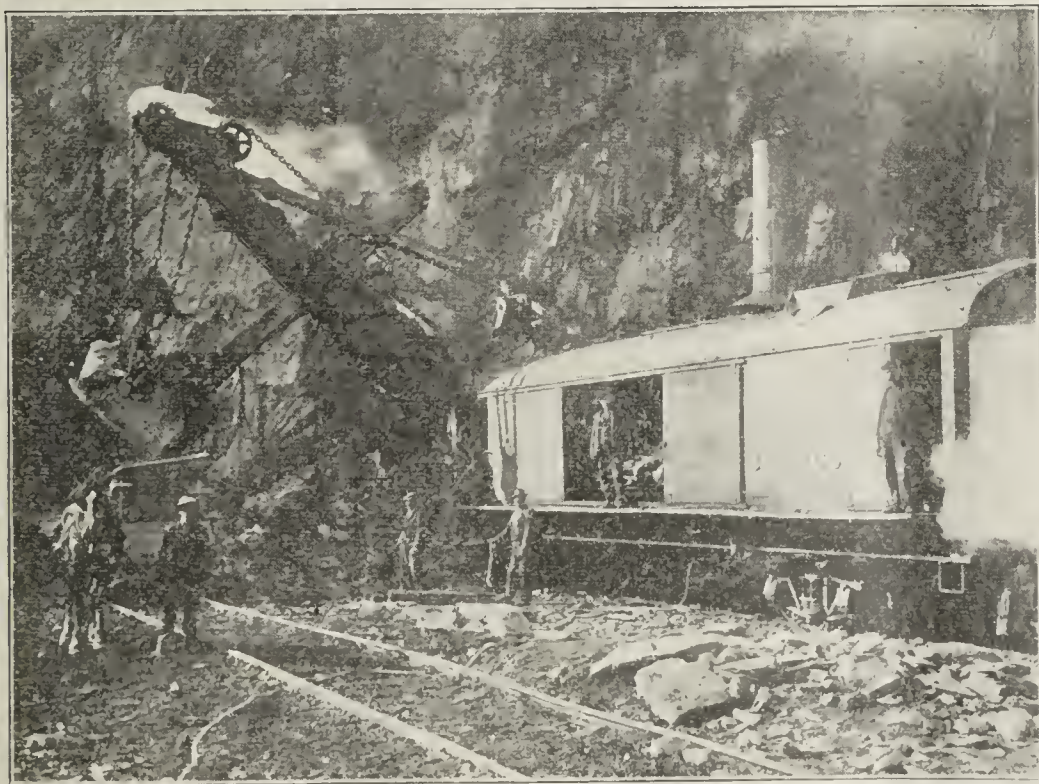
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Yours very truly,
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Gentlemen:—Your hand power Derrick No. 1 arrived O. K. some two months since. I have given it some very severe tests and found it to meet every requirement.

You claim a capacity of 1,500 pounds for it, and the first thing I did with it was to set a corner stone that weighed 2,100 pounds and it handled it nicely.

Very respectfully,
JOHN D. BLEVINS.

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971 N. Francisco Ave., Chicago.

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Our one regret is that we did not run across the Derrick at an earlier date. It would have saved us money.

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Extensive Deposits of Raw Material. Proximity to Large and Growing Markets. Low-Priced Fuel Supply.



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We are averaging from 5½ to 6 barrels an hour per mill. We trust the above will answer your inquiries.

Yours very truly,

Pulverizer Co.

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ZEIGLER COAL

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Zeigler Coal

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**Low in sulphur 1-2 of
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ARCHITECTS' AND ENGINEERS'
HANDBOOK OF**Re-Inforced**
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172 pages.

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By L. J. MENSCH, C. E.

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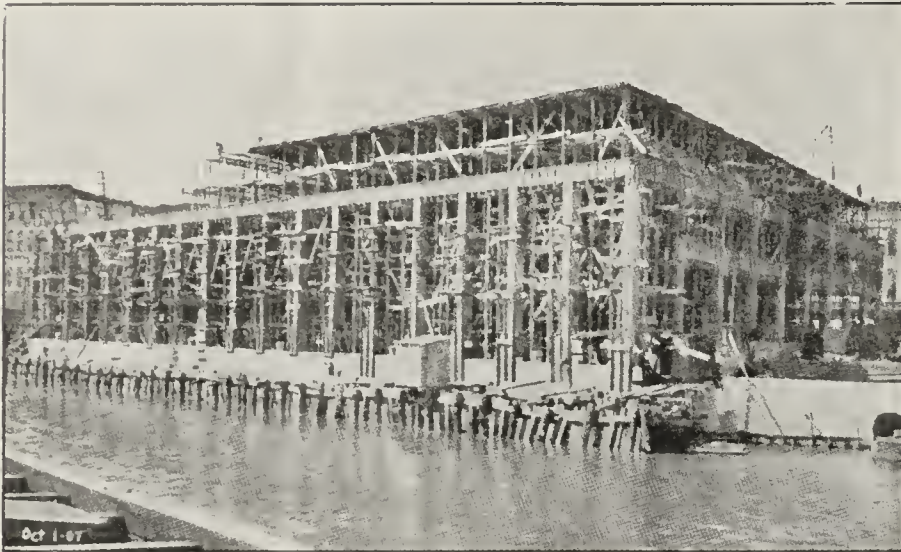
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Cement and Engineering News

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Makes all concrete watertight



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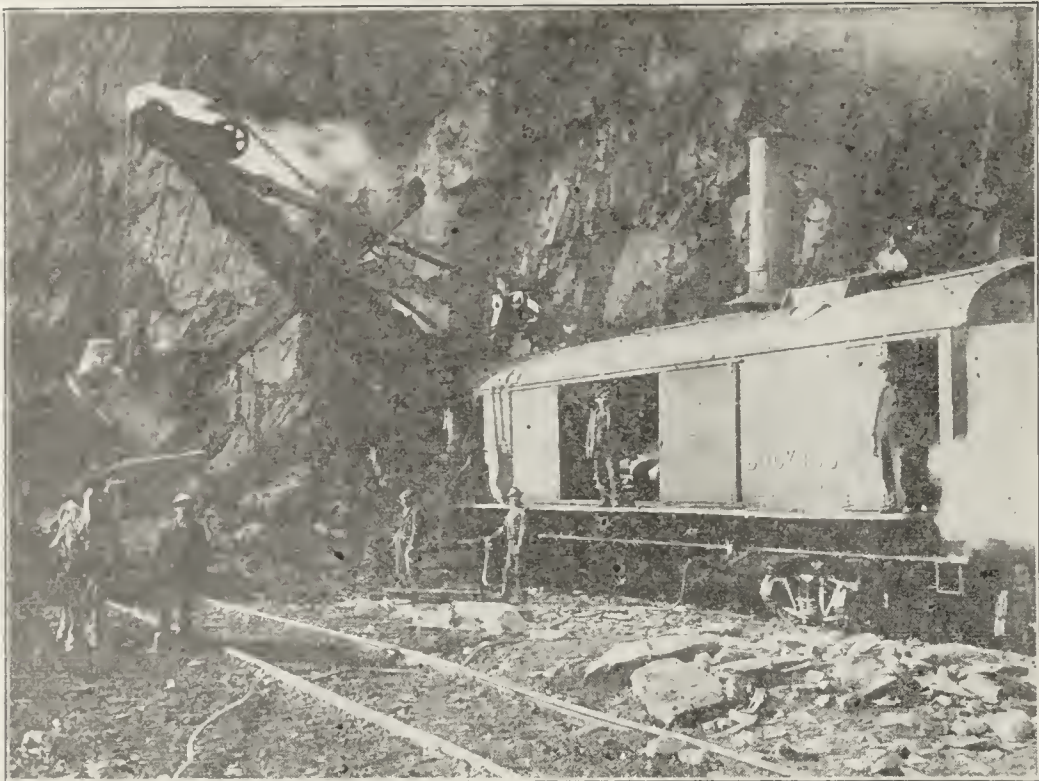
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CEMENT

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ENGINEERING NEWS



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This Building is a Reinforced Concrete Structure in which the Hallberg System of Reinforcement is used.

L. G. HALLBERG, Architect, Chicago.

CEMENT AND ENGINEERING NEWS

(PUBLISHED MONTHLY)

WILLIAM SEAFERT, Editor and Publisher

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CHICAGO, OCTOBER, 1908.

CORRESPONDENCE.

We solicit correspondence on all matters of general interest to the cement trade in all its branches. Engineering notes, public improvements, and facts and opinions drawn from practical experiments will be welcome.

CONSULTING CONCRETE BUILDING EXPERTS.

It is a serious mistake for persons contemplating the erection of concrete structures, either plain or reinforced, to consult with architects unfamiliar with this class of work. There is a class of architects, willing and content to follow in the footsteps of their fathers. They do not favor innovation on ancient methods, and are therefore opposed to concrete buildings. Such men are not safe advisors when consulted, and should therefore be avoided. The architect qualified to design reinforced structures, must have an engineering education, as each structural member in a reinforced concrete building must be calculated anew for the loads and stresses to which it is to be subjected. The great architects of the past were great artists who produced harmonious structures embellished and adorned with suitable ornaments to give grace and beauty the design, using ponderous masses of masonry in walls and partitions. The Chinese use great masses of material in the walls of their buildings and cling to this style of construction with the same persistency as our own antiquated architects, who have set their faces against modern concrete construction. For instance the Philadelphian school board, which was investigating fire proof construction for school buildings, consulted with many leading Philadelphian architects on the suitability of concrete for such buildings. Not a single positive answer in favor of concrete was received from these Philadelphian architects. The simply cast suspicion on concrete as a building material. Had the Philadelphian school board consulted with engineers, the answers would certainly have been favorable to the choice of concrete for these school

buildings. There are many architects who favor concrete for building purposes simply because they recognize in concrete a modern, up-to-date building, which in competent and experienced hands will produce sound and durable structures. The architects who attempt to throw cold water on concrete as a building material, is, in the light of present events, simply a back number. It is a case of the blind leading the blind, when he advises his clients against the use of concrete.

AN EXAMPLE OF THE DECOMPOSITION OF CONCRETE IN SEA WATER.

In many of our past issues we have discussed the effect of sea-water on concrete structures and reprinted letters describing the experience of various engineers in this matter, but never before, we believe, have we been able to show such a marked case of disintegration as is illustrated in the accompanying views of the seawall to some docks in the Charlestown Navy Yard at Boston, Mass. These arches are of non-reinforced concrete some 20 ft. wide and form the curved boundary to an earth and rock filled dock the filling for which tails down under the arch. The portion shown in the views was built in 1901 under the direction of the Bureau of Yards and Docks of the U. S. Navy Department a bureau that has a reputation for the most careful and thorough work. We are not able to procure any definite information as to the conditions of material and workmanship from any one who was connected with the work during construction, but through the courtesy of Mr. Fred

Thompson, M. Am. Soc. C. E., Civil Engineer, U. S. N., now the engineer officer of the navy yard, we procured the photographs herewith reproduced and such information as the records of the office show.

The docks are located in the tidal salt water of Boston Harbor, which at this point is not highly polluted with sewage or factory waste, but which is subjected to considerable freezing weather and a 10-ft. range of tide. The concrete portion of the docks, built seven years ago, was constructed with all the care for which the Bureau is noted. The specifications call for continuous construction from pier to pier of the arch rings and for a 3-in. 1:1 mortar face on all exposed surfaces. The mass concrete was a 1:2:4 mixture for 2 ft. back of the face and 1:3:6 for the interior, a standard cement and a local gravel being used. For the cement, all the usual specifications were prescribed with the following interesting clause:

"The contractor must furnish satisfactory evidence of the durability in sea-water of the brand of cement he proposes to furnish."

In the construction the arch ring was first laid and after it was completed the showing spandrel walls built, the whole being of the dry well-tamped concrete so much used at that time.

The photographs show without much further explanation the present condition of the face of the arches. It will be noted that the line of the extrados of the arch and the horizontal places where the parapet work stopped are both plainly marked in the decomposition. This rotting has extended for a considerable distance back into



Fig. 1. Near view of decomposed Concrete Sea Wall in Boston Harbor.

the concrete mass so that the mortar face alone is not responsible for the damage.

The government authorities on the work have no explanation to make of the cause of the disintegration, merely giving the facts in the case. It is well to note, however, that the decomposition occurred in probably a porous concrete, as it was mixed and laid dry with no especial effort toward density or waterproofing, and that the structure is in tidal sea-water, subjected to alternate freezing and thawing and finally that the damage has been done mainly between the high and low water levels.—(Engineering News.)

CHICAGO BELTING COMPANY'S NEW REINFORCED CON- CRETE FACTORY BUILDING.

One of the best examples in modern fireproof factory construction is the building recently constructed at Chicago for the Chicago Belting Company. This building was designed by Architect L. G. Hallberg, and the engineering work was done by Stewart Hodges, in which he used the Hallberg system of reinforcing.

The building is 144 feet front, 117 feet deep, five stories and basement in height. The exterior walls are of brick with floors, columns, girders and stairs in reinforced concrete, the spans being 19x20 feet, with a 12x14 inch girder and an 8-inch floor slab, recently this building was subjected to a very severe test, carrying a load of 228,000 pounds in the panel and 156,000 pounds on the girder. This means that every square foot of the panel surface was carrying a load of 600 pounds, and that every square foot of the girder surface was carrying a load of 1,300 pounds. Only the slightest deflection was perceptible.

This building embodies the most up-to-date ideas in reinforced concrete design. "In this system," said one of Mr. Hallberg's representatives, "the strain curves are followed and resisted by reinforcements. The tension in the girder or beam is taken care of by the bars placed in strain curves. These bars have their ends anchored and placed beyond the column in the abutting girder, one beyond the other. This arrangement places this part of the girder in cantilever. The distinct advantage may be readily seen. Hence, we have the girder both continuous and acting directly as well as the cantilever. Great strength with the use of comparatively small amount of steel is the result. We

adhere closely to our claim of not a pound of metal wasted. Our shear bar is placed where shear occurs, and as a tension bar where there is no shear. Our method of taking care of the shear is very unique. The bar is bent in a series of loops and it is impossible for a shear crack to cross this girder without cutting one or more of these members.

"Our reinforcement in the panel is so placed that it forms a continuous body in two directions. The great strength attained by this method with a minimum use of steel, readily impresses itself upon the engineer. Our reinforcement is at once the strongest and cheapest. We have designed reinforcements for buildings for the last fifteen years without failure or accident.

curely either by a loop and a dowel pin or by bending the end of the bar over at an angle. This form of securing the bar holds it in more efficiently than any system of deformed bars could possibly do. The experienced constructor knows that it is practically impossible for the concrete to be worked into the little deformations in some of these so-called mechanical bonds."

This architect and engineer have designed some twenty similar buildings in the city, among which are the Republic Metalware Company's building, the Chicago Flexible Shaft Company's building, the Addressograph building, Gottmann & Kretschmer Company's building, the Price Baking Powder Company's building, the Wilder & Company's build-

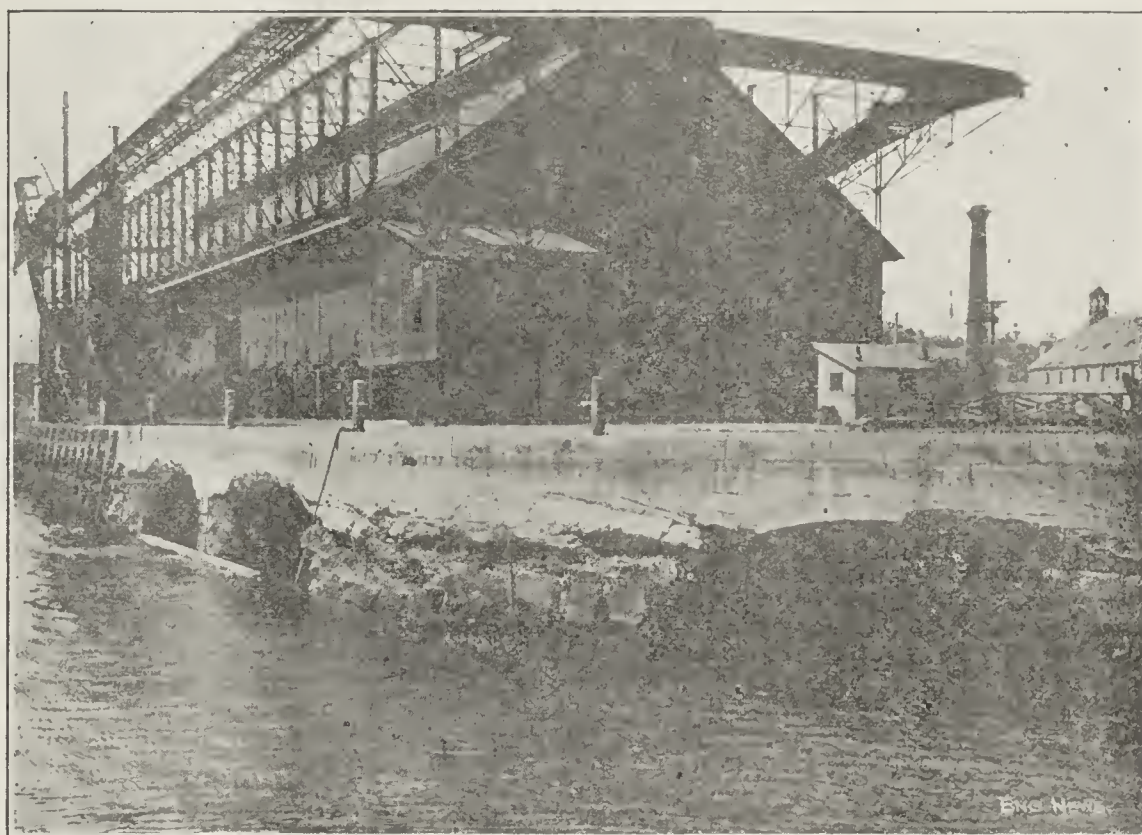


Fig. 2. View of Charlestown Navy Yard Dock Wall.

Many of these buildings contain very heavy working machinery.

"We use bars of a rectangular section, as they of their own accord assume a sagged form that always will be in tension, then it also gives a greater depth between the center of reinforcement and the compressive body of concrete, just like the flange of an I beam, from it very form, is more effective than it would be in any other shape. In a flat bar of uniform cross section every pound of metal counts, not so in the deformed bar, as no bar is stronger than its weakest part. Therefore, the deformed bar carries lots of useless metal.

"Every one of experience knows that it is absolutely necessary to have the reinforcement anchored so as to avoid any chance of its slipping or moving of the reinforcement in the concrete is impossible, as the ends of the bars are anchored se-

ing, the Felt & Tarrant Company's building, and the Eugene Dietzgen Company's building. All of these are constructed in the same careful and conservative manner, which insures reinforced concrete construction of safety and permanency.

THE NEW MILL OF THE CALIFORNIA PORTLAND CEMENT COMPANY.

The California Portland Cement Co., has recently placed in operation at Colton, Cal., 55 miles east of Los Angeles, a new cement mill, with a capacity of 2,500 barrels a day. This company also operates another mill at Colton, which is the pioneer mill on the Pacific Coast and one of the earliest to be built in this country. The capacity of this original mill is 500 barrels a day, but the output has for some years been insufficient to supply the demand for the cement produced. Consequently, the construction of the new mill was start-

ed adjacent to the original one in March, 1907, and is now practically finished.

The original mill is on the north side of a hill of nearly pure limestone rock that rises to a height of 500 ft. above the valley in which it is located. The new mill is on the opposite side of this hill, about a mile from the original one. The deposit of rock in the hill is unusually pure and high in lime, so clay is added to produce the proper mixture of raw materials. This clay is obtained from a deposit about 20 miles distant and is delivered over switch connections with the Atchison, Topeka & Santa Fe R. R. Both mills also have switching connections with the Southern Pacific and the San Pedro, Los Angeles & Salt Lake railroads, so that all of the shipping facilities in Southern California are directly available.

The new mill is just above the base of the hill, where advantage can be taken to considerable extent to handle the materials through the mill by gravity. The equipment of the mill is driven entirely by individual alternating-current motors supplied with three-phase 50-cycle 440-volt current. Power to operate the mill is obtained from the Los Angeles Edison Co., and is delivered at 33,000 volts, from which voltage it is stepped down to the operating voltage by transformers in the mill.

The quarry from which the rock is obtained is in a bench cut in the side of the hill, well above the mill. All of the rock in the quarry requires blasting. The loosened rock is loaded into end-dump steel-body cars, having a capacity of 80 cu. ft. each, and is delivered by hand on a down-grade 3.5-ft. gauge track to a tippie at a crusher house. The cars are dumped at this tippie by a compressed-air hoisting cylinder suspended from a gallows frame over the track. The piston rod in this cylinder carries a hook, which when attached to the rear end of the car, hoists that end so the rock is discharged at the front end into a chute leading down into the crusher house. This arrangement, although simple, is particularly effective. The empty cars are hauled back to the quarry by a horse.

The crusher house contains two Gates No. 6 gyratory crushers, into either or both of which the quarry rock can be discharged by gravity from the tippie. Each crusher delivers into the boot of a vertical, continuous-bucket elevator, 46.5 ft. between centers of the end pulleys. This elevator raises the crushed stone to an overhead horizontal drag conveyor, which extends over a

rock-storage bin adjoining the crusher house. Each crusher is belt driven by a 75-hp. continuous-speed motor; the elevator for each crusher is driven through sprocket chains, and the drag conveyor through a rope drive by the motor driving the crusher.

The rock storage bin is 40x80 ft. in plan and 15 ft. deep, having a capacity of 5,000 tons. It has 10-in. reinforced-concrete side walls and is covered with a galvanized iron roof. The two drag conveyors which deliver the output of the crushers to the bin are arranged to discharge at various points in the latter. The crushed rock can be drawn by gravity through eight gate openings in a row at the same level along the bottom of the down-hill side of the bin. These gates discharge on two



New California Portland Cement Plant.

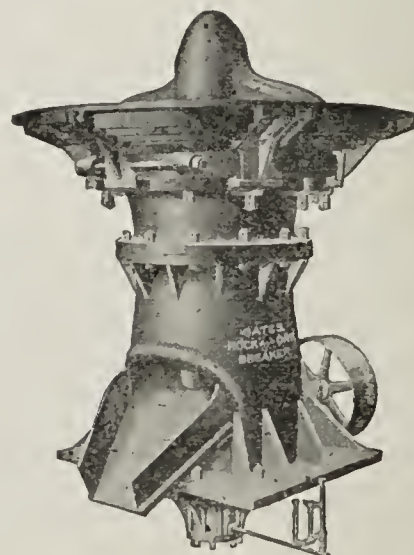
horizontal conveyor belts, one of which travels from one end and the other from the opposite end of the bin, toward the transverse center line of the latter, each serving four gates. These two horizontal conveyors deliver to an inclined belt conveyor, 45 ft. long, which elevates the crushed rock to a dryer house.

The dryer house contains three 5x50-ft. rotary dryers placed together in a row, two for crushed stone and one for clay. The inclined belt conveyor leading into the house from the rock storage bin delivers crushed rock at the top to either or both of two hoppers supplying two of the dryers. The clay is dumped from the railroad cars in which it arrives into a storage area under a trestle adjoining the dryer house, the floor of this area being about 15 ft. below the floor over the charging end of the dryers. The clay is reloaded from the pile, as required, into 1-yd. steel-frame and steel-body dump cars, which are hauled up an incline by a cable on a hoisting drum in the dryer house and are dumped into a hopper supplying the third rotary dryer. All three dryers are geared to a line shaft belt-driven by a 30-hp. continuous speed motor,

friction clutches being provided so any one dryer may be operated without relation to the other two. The same motor also drives the hoist used to haul the cars of clay up to the charging floor, and a screw conveyor by which large lumps of clay which pass through the clay dryer may be returned to the charging hopper again. The dryers are all arranged to operate on waste heat from the cement kilns, each being served by a 3.5x60 ft. steel stack on a reinforced concrete base.

A vertical bucket conveyor is provided at the discharge end of each dryer to elevate the output of the latter to an overhead horizontal flight conveyor leading to dry materials storage bins in the raw-grinding building, which adjoins one side of the dryer house. The eleva-

tors serving the two stone dryers both discharge into an overhead flight conveyor, which is 72 ft. long and delivers to a 500-ton elevated storage bin in the raw-grinding building. The clay elevator is also served by a separate flight conveyor, which delivers to an elevated storage bin adjoining the dry-rock storage bin. The three elevators and the two flight conveyors are driven from a line shaft belted to a 50-hp. continuous-speed motor. The elevators are driven from this shaft by sprocket chains and the conveyors are geared to jack shafts, a friction clutch being provided at each unit.



Allis-Chalmers Style "K" Gates Breaker.

The elevated dry-stone and dry-clay bins have side and ends built of 2x6-in plank, laid flat in crib fashion, and are on a heavy monolithic concrete base. A reinforced-concrete tunnel extends longitudinally under this base at an elevation that brings the floor in the tunnel above the floor of the building. A 2-ft. gauge track is laid in this tunnel, the latter being 40 ft. long and of sufficient cross-section to permit a 1-yd. steel-frame and steel-body dump car to be operated in it readily. Dry clay is drawn into this car through under-cut gates in the bottom of the clay storage bin, and is trimmed to a predetermined weight on platform scales at that end of the track. The car is then shunted under the dry-rock bin, where it is filled with crushed stone through any of four under-cut gates in the bottom of that bin; when filled, the car is pushed to a second platform scales at the other end of the tunnel track and there trimmed to the proper weight to produce the necessary proportions of clay and stone.

The proportioned loads are dumped from the tunnel car into the boot of a vertical bucket elevator of the continuous-bucket type, which is close to the second platform scales. This elevator discharges on a horizontal belt conveyor extending over a row of three No. 8 Allis-Chalmers ball mills. The elevator and conveyor are driven by a 20-hp. continuous-speed motor; the elevator is directly driven by a sprocket chain on a jack shaft belted to the shaft of the motor, and the conveyor is gear driven from a line shaft.

This horizontal belt conveyor is arranged so part or all of the materials handled by it may be delivered at three different points to supply bins over the ball mills. The latter are fitted with screens having $3/8 \times 1/2$ -in. slotted holes, permitting them to be operated at high speeds and to large capacity. Each mill is belt-driven by an individual 50-hp. continuous-speed motor; the three motors are on a raised concrete floor in the rear of the mills, where each of them is provided with a starting box and resistance.

The ball mills discharge directly into a screw conveyor placed longitudinally in the concrete base on which the three mills are mounted. This conveyor delivers to the boot of a vertical high-speed bucket elevator, which raises the material to an overhead horizontal screw conveyor extending across to a longitudinal screw conveyor over a row of ten Fuller-Lehigh pulverizer mills on the opposite side of the building from the ball mills. One 30-hp.

continuous speed motor drives the screw conveyor under the row of ball mills, the high-speed bucket elevator and the two overhead screw conveyors. The lower screw conveyor and the elevator are driven by sprocket chains on jack shafts, while the two overhead conveyors are geared to shafts driven by the motor. Each unit of this group of conveyors is arranged so it can be thrown out of service by a friction clutch.

The row of ten Fuller-Lehigh pulverizing mills is directly across from and parallel to the row of ball mills. The longitudinal screw conveyor over the pulverizing mills is arranged to discharge to any or



Allis-Chalmers Ball Mill.

all of the latter through down spouts. Each of the mills is belt-driven by a 50-hp. continuous-speed motor, the ten motors being in a row at the rear of the row of mills, where they are each provided with a separate starting box. The belt pulley on the shaft of each motor is 15 ft. on centers from the driving pulley of the corresponding mill; the 14-in. belts used to transmit power from the motors to the mills are operated satisfactorily with a quarter turn in this short reach. The motors run at 700 r. p. m. and the mills at 210 r. p. m.

The rather coarse product of the ball mills, as equipped, is ground by the pulverizing mills to an average fineness of 86.2 per cent. through a 200-mesh sieve and 97.7 per cent. through a 100-mesh sieve. The

mills discharge into a screw conveyor laid longitudinally under the row of mills. This conveyor delivers into a high-speed perfect discharge bucket elevator at the end of the row of mills, which elevator raises the pulverized raw materials to a screw conveyor extending over a row of elevated supply bins at the charging end of the cement kilns. This group of conveyors is driven by a 30-hp. continuous-speed motor, with drives arranged generally the same as those of the group at the end of row of ball mills, permitting each unit to be operated independently.

The raw-materials supply bins at the charging end of the cement kilns are directly in front of the discharge ends of the rotary dryers, the materials making the circuit from the dryers through the raw-grinding building and back to these bins. The latter are built of reinforced concrete and have a capacity of 350 tons. At each of the five cement kilns supplied from them a transverse tunnel is placed under the bins, with the tunnel arch above the level of the bottom of the charging ends of the kilns. A cross screw conveyor, fed from three gates in the bottom of the bins, is placed in each of these transverse tunnels and discharges into a second screw conveyor leading into the kiln. The second conveyor travels at twice the speed of the first, to avoid any danger of choking the kilns. The conveyors to each kiln are driven by the same motor which drives the kiln, so the supply of materials is varied automatically with the speed of the kiln.

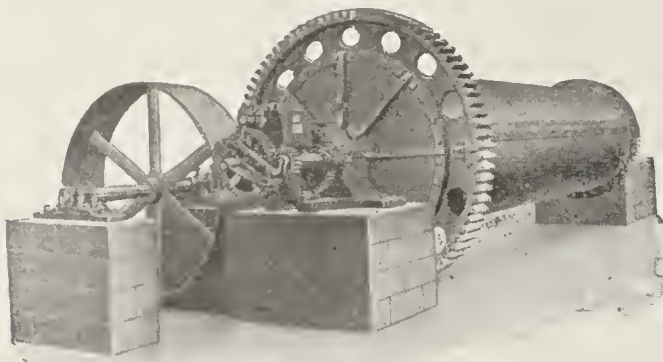
The five kilns provided are 120 ft. long and taper from an inside diameter of 7 ft. at the charging end to 7:5 ft. at the firing end. They were built by the Vulcan Iron Works, of Wilkesbarre, Pa., and are placed side by side in a row, in the usual manner. The charging ends



Shipment of kilns, dryers and coolers leaving the plant of the Vulcan Iron Works, Wilkes-Barre, Pa., to be installed in the California Portland Cement Mill.

are in a reinforced-concrete base for the stacks which serve the kilns, and the firing ends are surrounded by a building, but otherwise the kilns are not enclosed. Each kiln has three ring bearings mounted on concrete piers and is gear-driven from a line shaft belted to a 30-hp. variable-speed induction motor placed under the kiln near the transverse center line of the row.

The five steel stacks which serve the kilns are each 100 ft. high above the base and 5.5 ft. in diameter inside the brick lining, which is carried up 50 ft. above the base. The



Tube Mill built by Allis-Chalmers Co.

latter is 25 ft. high and 8 x 10 ft. in plan. Although the top and sides of the base are 10-in. reinforced-concrete slabs and the large openings for the kilns and stacks to be left in them, the stacks are carried by this base without any evident signs of failure.

The building over the discharge or firing ends of the kilns is 20x75 ft. in plan and had a 4-in. reinforced concrete floor, placed about 5 ft. above the ground level. The hoods of the kilns are each mounted on a four-wheel truck that runs on a 5.5 ft. gauge track laid in the reinforced concrete floor, a 10-in. beam being placed under both rails of this track. The floor in the rear of the kilns is clear so the hoods can be pulled back on the tracks readily to permit the kilns to be entered for repairs.

The kilns are fired with crude fuel oil, which is supplied at a pressure of 65 lb. per square inch at the feeding nozzle and is blown into the kiln by an air blast under a pressure of 95 to 100 lb. per square inch. The oil is preheated to 120 deg. Fahr. immediately before being fired, by passing it through pipes in a jacket over the end of the kiln. The operation of the firing feeds and of the motors driving the kilns is all controlled from the floor which carries the ends of the kilns.

The crude oil used for fuel is stored in a covered concrete tank placed at one side of the mill buildings. This tank is 30x300 ft. in plan and 12 ft. deep and has a capacity of nearly 24,000 barrels. A 4x6 in. duplex motor-driven pump de-

livers the oil from this tank to the kilns. From experience with oil-storage tanks built of concrete at the original mill of the company and at a marble-cutting works which occupied the site of the new mill, it is evident that the concrete in these tanks was certainly not damaged in any way by the oil during years of service, but was apparently much improved in strength.

Each of the kilns discharges the clinker into a 3x50-ft. rotary cooler. The five coolers were built by Vulcan Iron Works and are placed in a row, with their ends under the reinforced-concrete floor on which the ends of the kilns are carried. The ends of the coolers into which the clinker is fed from the kilns are closed, and a stream of water is applied continuously at that end to the hot clinker. The resulting steam and gases are blown out of the other end of the cooler by a blast of air applied with the water. The five coolers are all gear-driven from a line shaft belted to a 30-hp. continuous-speed motor; this shaft is arranged with friction clutches so the coolers may be driven independently.

The clinker is discharged from each of the coolers into a 2-yd. steel hopper, the five hoppers being in a row over a narrow-gauge track at right angles to the axes of the coolers. This track connects with two other tracks which extend up on a 40 per cent. grade to a steel trestle erected over a 50,000-ton clinker storage pocket adjacent to the coolers. This trestle also carries two tracks and is at a height of 30 ft. above the floor of the pocket. The latter has a concrete floor 90x120 ft. in plan; a reinforced-concrete abutment, with wing walls, is placed at each end of this floor to confine the clinker. The clinker is loaded into 1-yd. steel frame and steel-body dump cars from the row of hoppers at the end of the coolers, and the

cars are hauled up one track of the incline by a link-belt car hoist chain-driven by a motor at the top of the incline. When the cars reach the trestle they are readily pushed along the latter by hand, as the loaded-car track is on a descending, 0.66 per cent. grade. After a car is dumped at any point over the pocket it is shunted at the end of the trestle to the other track, which is on a 1 per cent. grade descending toward the incline. At the head of the latter the empty car is placed on a chain the same as the one in the ascending track and delivered to the foot of the incline.

A tunnel large enough in cross-section to permit 1-yd. dump cars to be operated in it is placed longitudinally under the middle of the clinker storage pocket. The clinker can be drawn into 1-yd. cars on a track in this tunnel through eighteen under-cut gates in the floor of the storage pocket. These cars are hauled up a double-track incline leading to the second floor of a 73x163-ft. cement-grinding building by a link-belt hoist arranged the same as the one at the other end of the storage pocket.

The clinker is discharged from the cars in the cement-grinding building into a supply bin over a row of three Allis-Chalmers ball mills. After passing these mills the clinker is finely ground in a row of fourteen Fuller-Lehigh pulverizing mills, the cement having a fineness of 99 per cent. through a 100-mesh sieve and 87.7 per cent. through a 200-mesh. The arrangement of all the equipment and conveying apparatus in this building is the same as that in the raw-grinding building. The screw conveyor under the row of pulverizing mills delivers to a high-speed perfect-discharge bucket elevator, which discharges on a screw conveyor extending over bins in a 60x260-ft. cement-storage building adjoining.



How an 8 ft. x 125 ft. two-tire kiln is loaded at the plant of Vulcan Iron Works, Wilkes-Barre, Pa., ready for shipment to the new California Cement Mill.

The floor of the cement-storage building is of concrete, laid directly on the ground. The sides of the ten bins into which the interior is divided are built of 2x6-in. plank, laid flat. Each of these bins has a capacity of 6,000 barrels, making the combined storage capacity 60,000 barrels. A platform, 10 ft. wide, is provided along both sides of the row of bins, and a portable sacking machine is moved along these platforms to any of the bins, as desired. The sacked cement is loaded directly from the platforms into cars on switch tracks along both sides of the building.

All of the conveying equipment in the entire mill is of standard sizes, capacities and speeds. The conveying belts are 20 in. wide and are arranged to run at a speed of 200 ft. per minute. The perfect-discharge bucket elevators, operating at 300 ft. per minute, are all of one size. The screw conveyors are uniformly 12 in. in diameter and operate at 75 r. p. m., except those feeding the cement kilns. All of the conveying apparatus, except the conveying belts, is thoroughly enclosed, which arrangement, combined with the type of grinding equipment installed, reduces the amount of dust in the air to a minimum. The conveying equipment was built by the H. W. Caldwell & Sons Co. of Chicago. The motors throughout the mill were built by the Allis-Chalmers Co. and are designed specially to operate in the dusty surroundings.

The compressed air required in various parts of the mill is furnished by two compressors in a separate building near the kilns. These compressors are of the two-stage cross-compound type, each with a capacity of 1,040 cu. ft. of free air a minute delivered against a pressure of 100 lb. per square inch when operating at 158 r. p. m. Each compressor is belt driven by a 200-hp. continuous-speed induction motor and has sufficient capacity to supply the demands of the mill. This building also contains four 1,000-kw water-cooled transformers, in which the incoming 33,000-volt current is stepped down to 440 volts for distribution through the mill. Space is also provided for two additional 1,000-kw. transformers to provide for increased capacity of the mill. The incoming high-tension line is carried on poles, while the power distributing circuits are all in conduits laid underground to and through the various buildings.

The construction of the mill was started in March, 1907, and the first kiln was fired in November last,

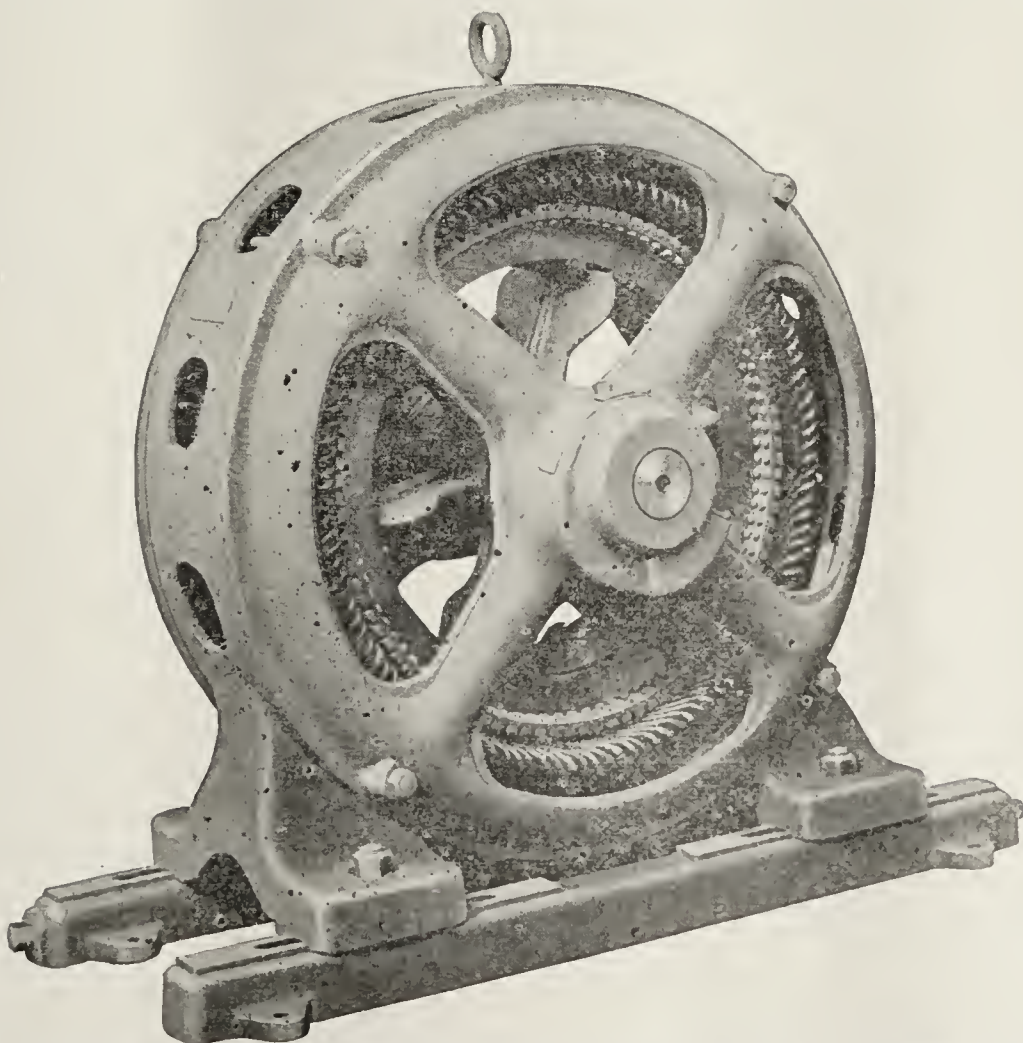
while the entire mill was practically completed in ten months after construction was commenced. This rapid progress is specially noteworthy, in light of the fact that all of the equipment was purchased in the East, and deliveries across the country by freight are exceedingly slow and uncertain. The large volumes of concrete used in the construction work were made in a single 3/4-yd. mixer mounted on a portable frame. Broken stone for the concrete was furnished by one of the crushers of the mill, which was installed temporarily to deliver to a belt conveyor that discharged into a rotary screen.

Since the mill is considerably isolated, various expedients had to be adopted during the progress of the construction. Among these was the erection of the five tall steel stacks serving the cement kilns. The steel shell of these stacks was delivered at the site in rings 6 ft. wide. The rings of the first stack were erected in place, one at a time, by using a small gin pole, which was lashed to the portion of the stack already built and then hoisted as the stack increased in height. The remainder of the stacks were assembled complete on the ground and each hoisted into place by using the last one erected in each case as a gin pole. The steel shell of each stack weighed 9 tons, but the stacks were all erected in this manner without mishap, each stack requiring about 9 hr. to set.

The officers of the California Portland Cement Co., are as follows: Messrs. Dan. Murphy, president; G. E. Bittinger, vice-president, and T. J. Fleming, secretary and general manager. The mill was designed by Prof. R. C. Carpenter, of Ithaca, N. Y. Mr. E. Williamson Miller was superintendent; Mr. R. H. Huber, engineer, and Mr. Geo. L. Nicholas general foreman, during the construction which was handled by the forces of the company. Mr. W. W. Welsh is superintendent in charge of the operation of the mill; Mr. H. C. Knapp is superintendent of power and Mr. W. C. Hanna, chemist.

During the first eight months of the present year we shipped 88,536 barrels of domestic cement to three of our insular possessions valued at \$161,145 as follows: to Alaska 1,701 barrels, valued at \$4,879 to the Hawaiian Islands 24,327 barrels valued at \$59,547 to Porto Rico; 62,508 barrels valued at \$96,719.

Tables and useful data for obtaining the pressure on retaining walls, bins and silos; diagrams giving safe loads on slabs of various thicknesses, spans and reinforcements; strengthening hooped columns based upon the French commissioner's report. The work is full of mathematical formulas useful to the educated engineer engaged in reinforced concrete construction work.



75-H. P. Allis-Chalmers Type "AN" Induction Motor. Sixteen motors of this capacity were built for the California Portland Cement Co., and thirty, varying in sizes from 1 to 50 h. p.

CONCRETE BOATS.

In reviewing the early history of reinforced concrete, we find the first structure of this character was, in all probability what would now be popularly considered a curiosity, a concrete boat.

M. Lambot, a Frenchman, in the year 1850, constructed a concrete boat and five years later exhibited it at the Paris Exposition. So far as we are able to learn, this was the first reinforced concrete structure, and in 1855, M. Lambot took out a patent on his invention. His patent claims show that he considered reinforced concrete to be specially well adapted to boat building. In 1861, M. Joseph Monier, a gardener of Paris, constructed some water-tanks and vases by forming concrete over a framework of wire netting. Monier is usually given credit for the discovery of reinforced concrete, but Lambot's patent shows that his discovery ante-

dated Monier's by several years.

barge with loaded drafts of 3 1/2 feet, the safe maximum for the present Missouri River channel.

It will be noticed from the illustration that the model is almost without keel, the bottom of the hull sloping from the sides to a very slight ridge line in order to secure a light load draft.

Experimental data gained from these models taken with the calculation of the design of full sized boats of 300 tons and over, show that the difference in weight between steel and concrete, as applied to boat construction, comparatively small. Concrete offers less resistance to propulsion in water than wood or steel, and no painting is required. Their cost is about one-half less than steel boats and the maintenance cost is nothing, and last practically forever in the water. Since it is a well known fact that concrete improves with age, and especially so when kept in water,

raw materials for making concrete, can profit by their experience.

The additional cell room for the Baltimore jail are to be constructed of reinforced concrete the same style as are found in the United States prison at Atlanta, Ga. Building inspector Preston has been instructed to prepare plans and specifications for these cells. There was a strong and prolonged effort made for steel cells in this matter.

The American Brotherhood of Cement Workers, has entered its protest against unions in other lines of work, who take up cement construction when work in their own particular line is slack. The question of jurisdiction in these matters is to be taken up at Denver by the American Federation of Labor this fall for the final decision, in the mean time the American Brotherhood of cement workers have declared war on the hod carriers union, who are encroaching on the cement workers' field.

C. W. Nibley, son of Bishop Nibley, of Salt Lake City, is one of the chief promoters of the New Portland Cement plant which is to be erected in the city of Portland, Oregon.

CEMENT DUST PREVENTS ROT IN STORED POTATOES.

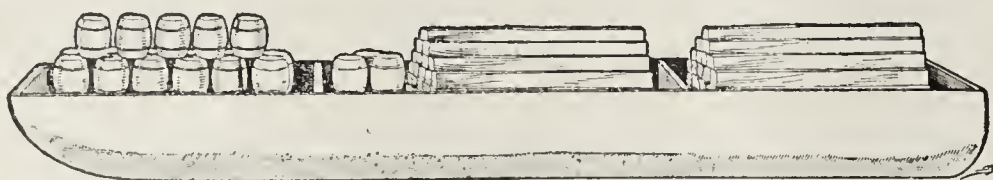
Mr. W. M. Wiland, in The Concrete Review says, that while building a concrete dam, the cement bags before being returned were taken to a building in where potatoes were stored and there shaken out, the dust settling upon the potatoes. During the winter the neighbors all complained about the rotting of their potatoes. I was surprised to find mine in excellent condition, my potatoes were sold in car load lots to jobbers who were surprised at the fine condition of my stock. For some time I did not make known the cause of their excellent keeping qualities, fearing some objection might arise. I have many times received better prices than my neighbors.

During the past four years we have been treating our potatoes in the same way, with the same excellent results.

The corporate name of the Dodge Coal Storage Company has been changed to The J. M. Dodge Company. James M. Dodge, Chairman of the Link-Belt Company, is President.



The power propelled boat has been built 1-60th of its size to carry a burden of 300 tons.



The Concrete Barge model 1-45th of its size to carry 300 tons.

dated Monier's by several years.

The idea of concrete boats seems to have been lost until we find, in the year 1907, that the Signori Gabellini of Rome constructed a reinforced concrete barge 150 tons burden for use on the Tiber and in coastwise trade. This boat has been used continuously since being built and has given excellent satisfaction. Subsequently, a large number of boats and barges of various kinds have been built in Italy and the Italian Government has made many experiments and tests with satisfactory and practical results. The French Government is also investigating the use of concrete for use in its navy. Experiments have been made in this country by the Moechel & Lowther Engineering Co., of Kansas City, Mo., on concrete boats for the navigation of the Missouri and Mississippi Rivers with very satisfactory results. The accompanying illustrations show a model to a 1/20 scale of a self-propelled river boat of 100 tons burden and 150 ton

the advantage of concrete for boat building becomes apparent.

One of the best demonstrations of the power of reinforced concrete to resist shocks is the trial made by the Italian Government with a steel and a concrete boat. A 1000 ton concrete boat was rammed by a much larger steel vessel, the result being that the concrete boat suffered less damage than the steel boat. Various trials of this nature have led the Italian Government to consider the armoring of their war vessels with concrete.

The use of boats made of concrete seems to be a favorable solution to the transportation problem on American rivers. The great distances between ports and other physical and economic conditions require boats of low initial and maintenance cost.

Since thickly settled countries, such as Italy and France, find concrete boats economical, it is the best assurance that America with cheap

NEW PLANT OF THE UNITED STATES CRUSHED STONE COMPANY.

The business of crushing stone for commercial purposes is as old as the country itself. Its development has been slow but sure. It has not grown in leaps and bounds like some other industries, but its progress has been steady nevertheless. When cement came into such general use a few years back a howl went up from the quarrymen, who thought they saw the death of their business. As a matter of fact it merely changed the complexion of the business. They had an idea that when the demand for rubble, flagging, rip-rap and curbing fell off their business was gone. Some few still have that antagonistic feeling. But the

many problems confronting the crushed-stone man today, and the solving of the same is no easy matter.

With the progress of the industry came better and cheaper methods of handling the materials and better methods of crushing the same. With this growth has come the organization of selling forces who fight for business.

Economy is the watchword in the crushed stone business. Old methods are giving way to new ideas. Of course the character of the stone is the first consideration, as the harder the stone the greater the cost, as a rule.

One of the model crushing plants adjacent to the city of Chicago is

day operated its plant to full capacity. The general method used in the vicinity of Chicago for unloading stone from the quarry into the quarry cars is by the employment of foreign labor, who load it by hand at a cost of about 10 cents per yard. The management of the United States Crushed Stone Company departed from this general custom and is using with great success two 100-ton Bucyrus steam shovels for this purpose. The only difficulty experienced in this method of operation is the fact that the ordinary gyratory crusher is so constructed that it cannot take into its hopper large blocks of stone capable of being loaded into quarry cars by steam shovels, and it seems that the deep-



The Steam Shovel Loading Car of crushed stone from stock pile. Made by The Bucyrus Company, South Milwaukee, Wis.

leading men in the business have come to realize that there is more to be gained by working in harmony with the concrete man. What the crushed stone man thought at first would be the death of his business has really been its salvation. More crushed stone is being used now than ever before, and with the advent of the concrete roadway, which is only in its infancy, the use of crushed stone will still further increase. This is merely mentioned as showing the growth of the crushed stone business and to give some idea of its future possibilities. It is needless to say anything at this time as to the many uses to which crushed stone is being put at the present time, for all of our readers are familiar with the same. There are

that of the United States Crushed Stone Company, says "Rock Products."

The quarry and plant are located at McCook, Ill., which is only a short distance from Chicago, and with unequaled railroad facilities, as it is located on the Santa Fe Railroad, the Chicago Terminal Transfer Railroad, the Indiana Harbor Railroad and Chicago and Illinois Western. At this point the company owns 300 acres of fine stone land, with comparatively no stripping to be done, as the stone crops out on the surface in many places. It is a limestone, running from gray to white in color, and remarkably free from flint.

This company began operating March 15, 1907, and from the first

er the stone is quarried, the larger the blocks become.

Having that in view, the management of this company have recently contracted with Thomas A. Edison, the inventor, for the exclusive license within the state of Illinois for the patented Edison rolls. Plans have been drawn and contracts let for the installation of a plant incorporating the Edison rolls, rolls to be installed have been especially designed by Mr. Edison personally, and are to be 7 feet long and 6 feet in diameter through a 6-inch opening in ter. These rolls will have a capacity of 10,000 tons in ten hours and will crush a block of stone weighing 10 less than thirty seconds.

At the present time the plant of

the company consists of a No. 8 Gates crusher and two No. 5 Gates crushers.

The quarry, which was opened in March, 1907, is at present about 1,500 feet long and 400 feet wide, with an average depth of about 50 feet. To give an idea of their operations, it is estimated that about 300,000 cubic yards of stone were removed last year. The loaded quarry cars run by gravity from where the steam shovel is loading them to the foot of the incline, where the cable hooker attaches them to the cables. This incline, which is at an angle of 40 degrees, leads up to the top of the No. 8 Gates crusher, and is hoisted up by a patented hoist which is capable of taking up two cars at once, both fully loaded, and has given eminent satisfaction at this point. While as a usual thing the cars carry less than four yards at a time, there is no difference in the time required taking the cars to the top, and if it is necessary three cars a minute can be safely handled. The crusher plant was constructed with an eye for economy in handling the material, and is as nearly automatic as it is possible to build it. The building is built on a solid concrete foundation which extends up under all the crushers.

After the material passes through the No. 8 Gates crusher it goes through the screens to the two No. 5 Gates crushers. The tailings are then taken up in bucket conveyors to the top of the building to the 24-foot screens. There are two of these big revolving screens, which were built by Allis-Chalmers Company, who installed them in the plant. What won't pass through a 2 1/4 hole is then returned and recrushed in two smaller crushers after which it is conveyed by means of belts out to the bins, where it is loaded into the cars, which can be placed

underneath or carried out and dropped in the stock piles. There are four elevators in all, of the usual bucket type, and a belt conveyor. A shaker screen for the concrete size is a very essential part of the equipment. The entire plant is operated

have on hand about 50,000 yards of crushed stone stored in the yards in various sizes. This is the winter accumulation and takes care of the summer rush. In addition to this they have two and one-half miles of track of 73-pound rail for the accom-



Quarry and plant of United States Crushed Stone Company at McCook, Ill. Bucyrus Steam Shovel at work in foreground.

by a 250-horsepower Allis-Chalmers Corliss engine, and three 160-horsepower boilers.

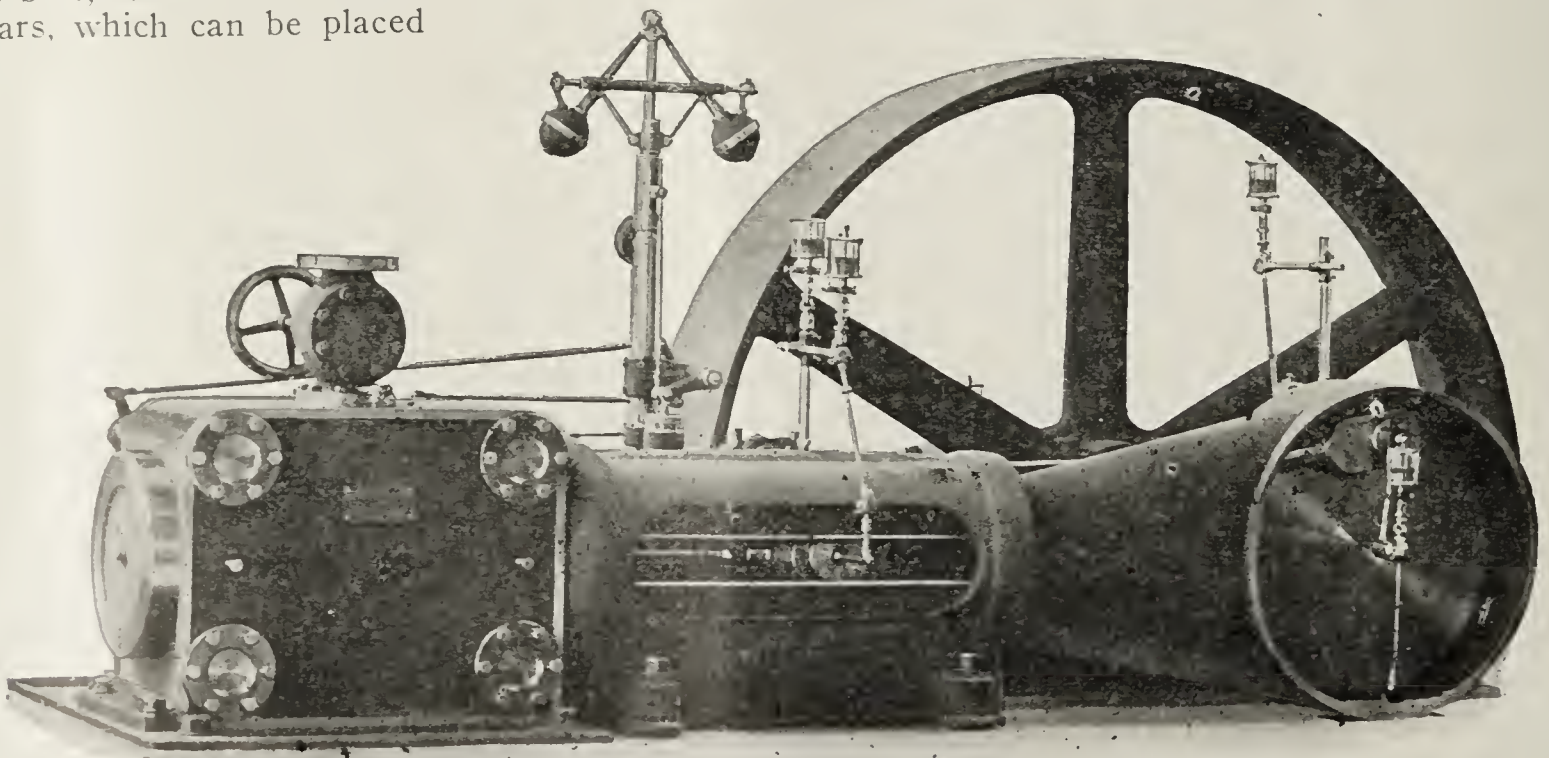
A large dynamo drives the hoist and the air compressor and furnishes light not only for the plant but for the quarry as well, so that operations here can be continued at night as well as day if necessary.

A complete storeroom containing all the necessary parts for repairing the machinery and equipment is also maintained, as well as a horse-shoeing department.

At the present time the United States Crushed Stone Company

modation of cars in the yards. A piling device is used in the yards for the proper handling of the material.

The new plant incorporating the Edison rolls will be operated entirely by electricity furnished by the Sanitary District of Chicago, and when the same is completed this company will have a capacity of 10,000 cubic yards of crushed stone each ten hours. There will be track room for nearly 500 railroad cars. The company will, in addition to its present locomotive, have two more locomotives to handle the loaded and empty cars in and about its yards.



Allis-Chalmers Corliss Engine Installed in U. S. Crushed Stone Co.'s power plant.

A REINFORCED METEOROLOGICAL OBSERVATORY.

There has just been completed on the top of Blue Hill, a few miles from Boston, a reinforced concrete observatory which presents some interesting features aside from its stability. One of the essential elements required in its design was absolute resistance to the entrance of water under the conditions of heavy beating rains at very high velocities.

As designed by George T. Tilden, architect, of Boston, the observatory is of circular section, 17 ft. 6 inches inside diameter, 20 ft. 6 inches on the outside, and 33 ft. high. The walls are of double thickness of 4 inches each, separated by a 10 inch air space which provides an absolute means of preventing the passage of water. The contract was awarded to the Aberthaw Construction Co. of Boston, already well experienced in this class of work.

Reinforced concrete was selected on account of its many advantages, important among these being its unyielding stability, freedom and vibration in high winds and its water tight qualities range up to 80 and even 100 miles per hour. Expectations have been so fully realized that the action of the self recording instruments has been entirely free from the unknown errors which were caused by the rocking of the old observatory, and there have been no signs whatever of leakage.

The observatory is built on a ledge, the walls being bonded thereto; the floor is slightly raised to provide an air space beneath. A separate 4 inch granolithic finish was put on top of the first floor to provide a smooth tread as well as to prevent any possible access of moisture. The general concrete mixture was 1: 2: 4.

Steel reinforcement consists of 1/4 inch square twisted bars spaced nine inches on centres, running in directions at right angles to each other, imbedded in the concrete near the surface, and extending into the wall.

The second and third floors and the roof are 6 inches thick, reinforced with 1/2 inch square twisted rods at right angles to each other and projecting into the wall. Those for the second floor vary in spacing from 12 inches on centres at the circumference to 5 inches apart at the centre. Steel reinforcement for the third floor and roof is practically identical with that of the second floor, but with an added number of bars at each side and at the middle end of the stair openings, and roof scuttle. The reinforcing bars are placed close to the bot-

tom of the floors, while those for preventing cracks close to the wall are placed near the top, being bent up at the wall and hooked over the nearest inside horizontal wall bar. All floors including the roof are granolithic finish; the latter is pitched towards the two water ways which connect with the drain pipes.

The inner and outer 4 inch walls are reinforced to the height of the second floor by 1/4 and 3/8 inch twisted bars. Above this 1/4 inch bars are used entirely except where the 3/8 inch bars are placed for

ond floors. One flue for both is built into the wall on the southeast side. Close to this are two other flues to be used for ventilating purposes. All flues terminate flush with the top of the parapet. Louvre dampers are used for regulating the opening of the ventilating flues.

Upon completion of the observatory many self recording instruments taken from the old tower were immediately installed so as to make no serious break in the continuous yearly records, and such instruments as could be set up in the



A Reinforced Concrete Observatory.

strengthening the flag pole socket. Concrete webs at 3 foot intervals connect the inner and outer walls, reinforced and connected to them by Z-bent 1/4 inch bars.

The stairs are of wood with wrought iron railings. The scuttle is provided with a window for observation in wet weather. The windows are in all cases double sashed and tight fitting. For taking outdoor temperature in winter and for other purposes a wooden set shelter is fastened to the sill of the second story window facing the north.

Heating is provided for by a fire place and grate on the first and sec-

adjoining library building were made use of during the process of reconstruction. On the first floor, in addition to three standard mercury barometers, are self-recording daily, weekly and monthly barometers, as well as a self-recording wind velocity meter and a self-recording wind direction meter. The two lat-to cloud observations and astronomical and weather vane by metal rods passing through iron pipes extending through the floors and roof. The rooms on the second floor are to be equipped with steel cases for the keeping of observation records, while the third floor is to be devoted

to cloud observations and astronomical work. On the roof are the continuous sunshine recorder, wind vane, anemometer and flag pole, the latter for the display of weather signals.

From an architectural point of view the new tower closely approximates the style of its predecessor. The smooth clean cut concrete work with picked finish brings out the simple but effective designs, decidedly appropriate in a structure of this kind, in a much more striking manner than was possible with the old observatory.

Altogether the observing tower is one of extreme durability, calculated to withstand the severe climatic changes, which it is sure to experience. The concrete contractors and engineers are to be congratulated on a most excellent piece of concrete construction.

FIRE TEST HOLLOW CONCRETE WALLS MADE UNDER THE FERGUSON SYSTEM.

Probably the most important example of the heat-resisting qualities of hollow concrete walls that has ever occurred was the fire which destroyed the stock of furniture and the interior of the building of Montgomery & Co., in Nashville, Tenn. The appearance of the building after the disastrous fire is shown by the accompanying illustration.

At one time during the fire the upper walls of the building as well as the concrete ornamental cornice and top courses were almost at a white heat, at least they seemed to be transparent, but after the fire was over and the building was approachable it was discovered that notwithstanding the great volumes of water poured upon the concrete walls while in such a heated condition, little or no change had resulted except for a few chips in the sills of the windows and the blocks next adjacent to such openings. The walls were intact. The chipping of the blocks so exposed to the terrific heat in direct contact with the flame for more than an hour was trivial and was repaired at slight expense.

As a fire test upon concrete blocks, the results of such a conflagration is sufficient to demonstrate the splendid fire-resisting qualities of concrete blocks made of the materials that were used in the construction of this building. Formerly a brick building occupied the same site. It was known as the Manix building, and it also burned. The brick walls were crumbled to such an extent that they had to be removed and the present structure of concrete



Concrete Blocks Not Injured by Fire.
Montgomery & Co. Building, Nashville, Tenn.

blocks, one of the first business buildings of its kind in Nashville, was constructed on the lot.

After the second fire the building inspector, after a critical and careful examination of the walls, pronounced them sound. The concrete block walls did not have to be torn down because the action of the fire had impaired their structural value in no way whatever.

The building was constructed of

hollow concrete walls made under heavy pressure, under the Ferguson system, controlled by the American Hydraulic Stone Company, Railway Exchange Building, Denver, Colorado, in the construction of which true concrete, with coarse aggregates and sufficient moisture to cause proper crystallization, is used. The concrete was made of crushed limestone, granite screenings and Kosmos Portland Cement.

IMPORTS OF CEMENT INTO THE UNITED STATES.

WHERE FROM	AUGUST				EIGHT MONTHS ENDING AUGUST			
	1907		1908		1907		1908	
	Quantity in lbs.	Value in Dollars.	Quantity in lbs.	Value in Dollars.	Quantity in lbs.	Value in Dollars.	Quantity in lbs.	Value in Dollars.
United Kingdom . .	12,482,800	\$42,796	2,061,300	\$ 7,903	145,254,016	\$500,798	51,086,810	\$200,974
Belgium	22,846,889	70,701	7,091,043	22,858	191,561,585	567,620	96,259,951	309,023
France	1,812,600	7,111	1,934,500	6,622	9,505,900	35,104	6,192,105	22,328
Germany	18,974,986	55,075	1,459,350	5,311	210,817,890	661,443	79,593,586	270,756
All Other Europe . .	2,500	20	.....	.....	930,263	2,129	1,379,048	5,098
British North Am. .	139,650	877	707,800	3,402	284,650	1,779	1,026,850	5,084
Other Countries . .	600,000	3,375	.....	.....	4,858,218	25,884	845,019	1,912
TOTAL	56,859,425	183,955	13,253,993	46,096	563,192,522	1,794,757	235,883,369	815,175
Domestic Exports of Cement, bbls. . . .	110,630	174,936	61,003	91,569	595,816	984,022	590,293	900,945

There were 12,054,248 lbs. of imported Roman and Portland Cement, etc., in the United States bonded warehouses in August, 1907, valued at \$36,274, against 18,626,775 lbs. in August, 1908, valued at \$69,056.

For eight months ending in August, 1907, there were 77,847 tons of asphaltum imported in the United States valued at \$332,681, against 91,280 tons imported in eight months ending August, 1908, valued at \$386,460.

FIFTH ANNUAL CONVENTION OF THE N. W. CEMENT PRODUCTS ASSOCIATION.

At a general meeting of the Executive Committee of the Northwestern Cement Products Association, called by Martin T. Roche, President, at the Nicollet Hotel, Minneapolis, it was unanimously determined to hold the Fifth Annual Convention on the 2nd, 3rd and 4th of March, 1909, the place to be determined later by a committee composed of J. C. Van Doorn, C. A. P. Turner, O. U. Miracle, R. O. Miracle and Harvey B. Smith.

The Association has decided to present to the Minnesota State Fair a concrete building to be used solely for cement product exhibits. A committee composed of the following members was appointed by the chair to select a site on the fair grounds for the building: H. A. Rogers, E. Cobb, J. C. Van Doorn, D. L. Bell. A committee to draw plans was also appointed consisting of the following men: C. A. P. Turner, O. U.

Miracle, L. V. Thayer. The president of the Association shall act in conjunction with the different committees ex-officio

The Elk Rapids Cement & Lime Co., is running full capacity.

The Atlantic and Gulf Portland Cement Company, of Camden, N. J., has notified the Secretary of State of Alabama of its intention to do business in Alabama, designating as its Alabama agent, John London, of Birmingham, Ala.

NEWARK CAPITALISTS HAVE ORGANIZED A COMPANY AT \$1,500,000.

A number of Newark, N. J., financiers have organized a company, capitalized at \$1,500,000, to erect and operate as soon as possible a giant cement plant on the Riverside property, a mile or so above Bushkill, Pike county, Pa.

The Riverside tract contains about 350 acres upon a great portion of which there is a shale suitable for the manufacture of cement. It is understood that later on the Riverside Hotel property will be converted into headquarters for the cement workers. The hotel has not been open for several years.

A CORRECTION.

In the write-up in our September number of the new Dixie Portland cement mill and also the new Meramec Portland cement mill we failed to state that Williams' crushers were also installed in these plants. The Williams' crushers are made in St. Louis, Mo., by the Williams' Crusher & Pulverizer Company. Milton J. Williams, Old Colony Building, Chicago, is the general sales manager. Most of the cement mills throughout the country use Williams' crushers as they are finely adapted to cement manufacturers use.



The illustration shown above is a reproduction of a view of Plant No. 5 of the Universal Portland Cement Co., located on the Union Railroad, at Universal, Pennsylvania, near Pittsburg. The plant, which was recently completed, contains 9 kilns, 120 ft. by 7½ ft., and has a daily output of 4,500 barrels of Cement. The main buildings of the plant are the raw material building, 155 x 160 feet; burning building, 150 x 130 feet; finishing building, 150 x 160 feet; coal pulverizing building, 100 x 50 feet; storage building, 600 x 100 feet, with a capacity of 500,000 barrels, and an office building which is three stories in height, including the basement, and is a model of architecture as well as concrete construction. The buildings are all of reinforced concrete and steel frame construction, and are equipped with the latest improvements in the machinery line. The Universal Portland Cement Co. is a subsidiary company of the United States Steel Corporation, and this plant is operated entirely by electric power, generated at the Homestead Plant of the Carnegie Steel Company, and transmitted by high tension alternating current to Universal where it is transformed for distribution. A Bucyrus Steam Shovel is shown in the foreground. Nine Ball Mills and two style "K" breakers were installed in this plant by Allis-Chalmers Company.

NEW SECURITY PORTLAND CEMENT PLANT.

The first high-grade Portland cement plant to be established in the state of Maryland is now in active operation. The plant is that of the Maryland Portland Cement Company, located at Security, a new town which bears the name of the brand of cement which is its parent, and is located two miles east of Hagerstown, eighty-four miles west of Baltimore and eighty miles north of Washington, and directly on the main line of the Western Maryland Railroad, having connections with the Baltimore & Ohio, the Norfolk & Western, the Pennsylvania railroads, all of which give a splendid outlet for the finished product. The plant represents the latest improved

agement indicates sterling worth of Baltimore's conservative capitalists who stand for all that is straight, fair and honest, and whose venture is designed to win by the inherent high quality of their product alone. DeCourcy W. Thom, president; Loring A. Cover, secretary-treasurer; Major Frederic H. Lewis, consulting engineer; Carl M. Goodman, superintendent; Harry B. Warner, sales manager. The directors are Douglas Gordon, DeCourcy W. Thom, Loring A. Cover, Richard H. Edmonds, Richard N. Jackson, William G. Nolting, Archibald H. Taylor and Charles Catlett.

This company has no connection or relationship in any way with the old Maryland Cement Company, which some years ago manufac-

practically a fireproof plant. Moreover, the arrangement of the building has been so planned that future extensions and enlargements can be easily made at any time.

From the limestone quarry the rock is brought along tramways to the scales in cars of two tons capacity. At the scales the rock is weighed and the proper proportion of shale added, the latter being drawn from a bin directly over the cars. The car is then pulled up an inclined trestle to the crusher by means of a wire cable and automatically dumps into a No. 7 $1\frac{1}{2}$ McCully crusher furnished by the Power & Mining Machinery Company, Cudahy, Wis., from which it discharges into an elevator of the endless bucket type by which it is car-



Plant of Maryland Portland Cement Company, Security, Maryland.

Linhard kominuters furnished by F. L. Smidth & Company, New York, N. Y., were installed in this plant. Power and Mining Machinery Company, Cudahy, Wis., furnished the McCully crushers.

ideas in the manufacture of Portland cement, and deposits of necessary raw materials are in abundance for an almost indefinite period in close proximity to it, says "Rock Products."

Several years ago active steps were taken looking to the organization of a company and Charles Catlett, of Staunton, Va., and Dr. John Sharshall Grasty, of Baltimore, two geological experts, were engaged to study the situation and report on its possibilities. Exhaustive and careful examinations and reports were made on every phase of the proposition, with the result that it was decided that the raw materials were of such value and in such abundance as to justify the establishment of a plant, and accordingly the Maryland Portland Cement Company was organized with a capital stock of \$850,000. The list of officers and directors representing the ownership and executive man-

aged a slag cement at Sparrows Point.

The plant was designed, erected and equipped under the direction of Major F. H. Lewis, consulting engineer, Leeds, Ala., who has had wide experience in the preparation of plans for such plants. The many different buildings comprising the plant, together with their dimensions, include the power house, 90x110 feet; main boiler house, 38x75 feet; auxiliary power plant, 40x49 feet; crusher building, 24x50 feet; stone drier building, 20x90 feet; rock mill, 30x80 feet, with an extension 37x39 feet; kiln building, 36x140 feet; clinker mill, 69x81 feet; stock house, 60x260 feet; coal drier building, 29x50 feet; coal mill, 30x35 feet, and laboratory, 20x50 feet. These structures with the exception of the crusher and stone drier buildings are of substantial steel frame construction, covered with corrugated iron, so that this is

ried to a 48-inch by 12-foot revolving screen for separation. From the screen the material passes into two large steel storage tanks, thirty feet high and fifteen feet in diameter, having a capacity of about 800 barrels each. At the bottom of the tanks the material is automatically fed onto a belt conveyor, which takes it to the stone drier building, from whence it is elevated into a 60-inch by 50-foot rotary drier and is discharged upon a belt conveyor, by which it is carried to an elevator which, in turn takes it to the top of two 35-foot storage tanks similar to those already mentioned.

From these tanks a belt conveyor carries the dry material to the rock mill building, where it enters Krupp ball mills furnished by Thomas Prosser & Son. These mills represent the second stage in the grinding of the raw material. The material is then carried to five steel storage tanks, under each of which is

a Fuller Lehigh mill made by the Lehigh Car Wheel and Axle Company, Catasauqua, Pa., and supplying the third and final stages of grinding of the raw material. Running at the base of these mills and receiving the discharge therefrom, is a screw conveyor, which carries the now thoroughly pulverized composition to the kiln building, where it is elevated into two large steel tanks above the kilns, and which serve for storage. These tanks have a capacity of 285 barrels each. From them the material is fed into the kilns, two in number, and of the rotary type, seven feet in diameter and 100 feet long. Pulverized coal is used for fuel, being blown into the kilns by an air blast from a blower. The coal is pulverized and prepared for the kilns in the coal drier and coal mill buildings. The coal is conveyed from a trestle to the coal drier building, where it passes through a 30-inch by 30-foot drier, from which it is broken up by a set of 18x30-inch rolls and then passes for its final grinding into a Fuller Lehigh mill and is stored conveniently for feeding into the kilns.

The hot clinker is received into two inclined open bucket elevators, which discharge into two clinker coolers eight feet in diameter by thirty-two feet high. The air blast for the coolers is furnished by a 70-inch steel plate fan. From the bottom of these coolers the material is carried by a suitable system of elevators and conveyors to the top of two steel storage tanks fifteen feet in diameter and thirty-five feet high, from which a belt conveyor carries the material in the clinker mill, where it discharges into two rotary crushers, in which the clinker receives its preliminary grinding. From these the material is elevated to two steel storage tanks placed directly above two Linhard kominuters furnished by F. L. Smidth & Company, New York City, this being the second stage in the reduction of the clinker. From the kominuters the material is conveyed into two steel tanks, which serve as storage for two 16x16-foot Krupp mills, furnished by Thos. Prosser & Son.

The clinker upon passing through the tube mills has received its final grinding and is now finished Portland cement of the "Security" brand. It is conveyed to the stock house where twenty separate bins, each with a capacity of about 1,000 barrels, are provided for seasoning and for storage. Just below the floor level and running along the front of

the bins is a screw conveyor, which takes the cement from any bin desired and carries it to the far end of the building, where the packing room is located. The cement is packed into bags by automatic bag packing machines. The railroad side track runs through the packing house, and the bags are loaded on the cars from the packing floor, which is on a level with the floor of the cars.

The elevating and conveying system was furnished by H. W. Caldwell & Son Company, Chicago, Ill. The main boiler house is equipped with four 300-horse-power water tube boilers. Coal for the boilers is dumped from a trestle into a drag conveyor, which carries the coal to the boiler house floor.

The main power installation consists of two 400-horsepower heavy duty engines and one 300-horsepower engine. The two large engines furnish power by means of rope drives to the rock mill and clinker mill, respectively, thus making these departments distinct and independent in operation. The third, or smaller engine, is belted to a counter shaft which furnishes power to the kiln building and also drives two 120-kilowatt generators. These generators furnish power for the electric lighting and for driving motors, which are used freely throughout the plant.

An advantageous feature is a sep-

arate power plant for running the crushing department. The crusher power house also contains a steam driven air compressor which furnishes air to the quarry drills.

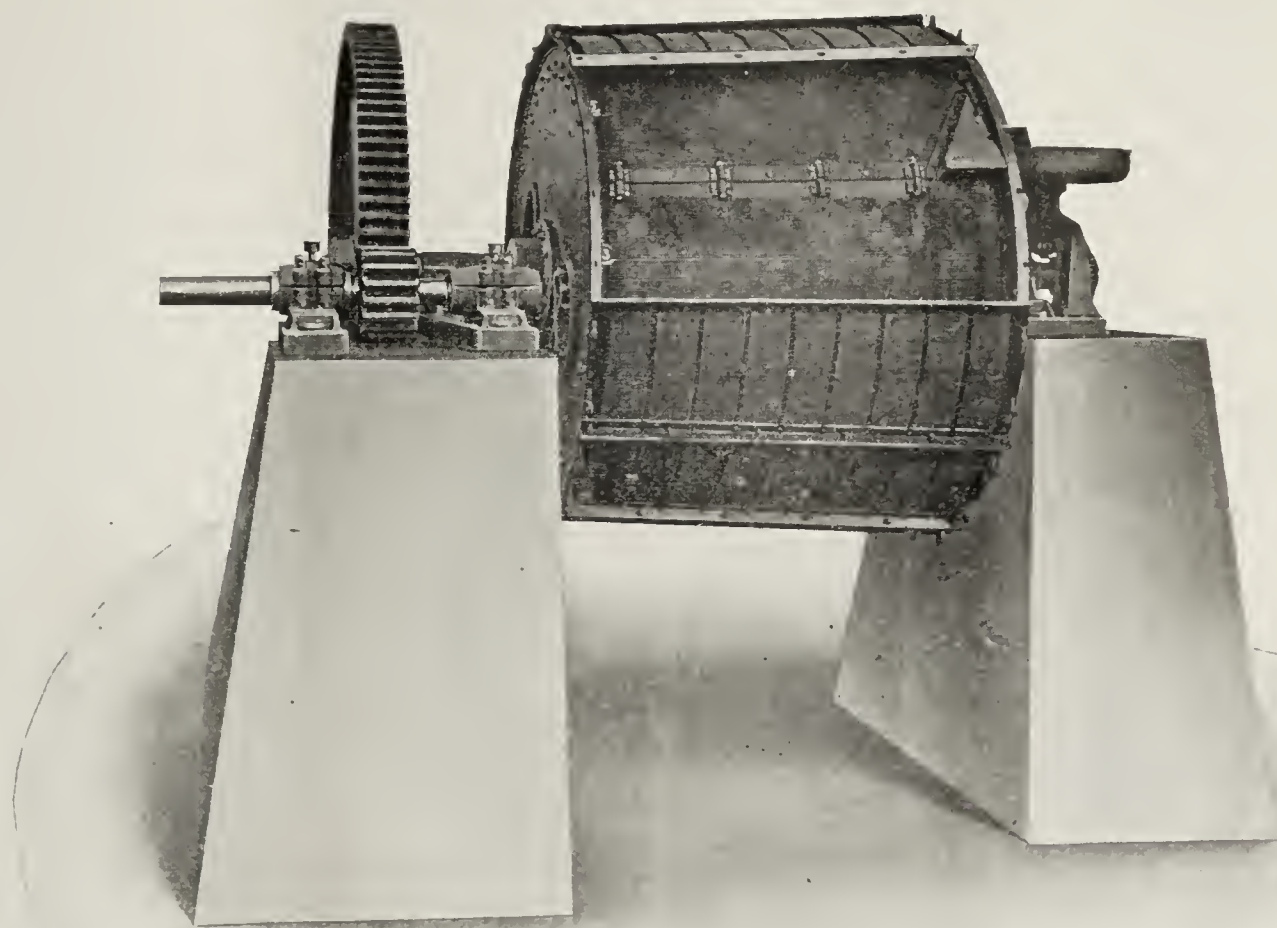
A splendid water supply is available from Antietam creek, which adjoins the plant, and a filtering system has been installed in connection with it.

By virtue of the ample storage capacity provided for each department or distinct division of the process of manufacture the chemist is enabled to keep well ahead of his work and maintain complete control of the product at every stage, and insuring one unvarying quality.

Throughout the design of this plant it was the aim to introduce every known mechanical device for rapid and efficient handling of the materials, also to duplicate as far as possible such apparatus in order to avoid delays and shut downs arising from the breaking of any special parts. This wise and liberal policy of the company is not only indicated in this feature, but also in general construction throughout the plant.

The initial daily capacity of the plant is 800 barrels of "Security" Portland cement, to be increased as the demand warrants.

The accompanying illustrations show the arrangement of the buildings for a continuous forward movement of the materials from the raw



No. 66—Kominuter—Inside and Outside Screens and Return Bucket for Tailings, manufactured by F. L. Smidth & Co., New York City.

state to the finished product. On the left can be seen the scale house and crusher building, where the raw materials are first received, and then in succession the various structures through which the materials pass until they reach the large building on the extreme right, which is used for storage and packing for shipment. Next to the storage house can also be seen the laboratory, which is constructed of concrete, with a concrete tile roof. The railroad trestle running the full length of the plant is used for dumping coal and shale.

The tracks of the main line of the Western Maryland Railroad can be seen running directly alongside the plant, giving direct shipping facilities, which are still more further enlarged by those heretofore mentioned as centering at Hagerstown, all freight to this point being transferred for a nominal shifting charge. Taking into consideration the proximity of the

raw materials, the splendid arrangement of the plant and the splendid shipping facilities, the Maryland Portland Cement Company is in a position to reach wide consuming area directly and quickly.

Dr. Grasty in the report on the deposits of this company for the Maryland Geological Survey makes the following comments, which are used with the consent of Dr. William Bullock Clark, the head of the survey:

"The limestone on this property is not only very uniform in composition, but is also low in content of magnesia. In none of the many analyses that have been made has the magnesia been found to exceed 3 per cent and is usually much below this.

"It will be observed that, besides the constituents being properly proportioned both in limestone and shale, each is very low in magnesia,

while the former is quite high in its contents of clayey matter.

"Large samples of these materials were procured and shipped to the well known chemists of Philadelphia, Pa., where in their laboratory they were made into Portland cement. The product was then tested and the results obtained were satisfactory in every particular."

The following analysis is indicative of the high grade quality of cement that the Maryland Portland Cement Company is introducing on the market:

Silica	23.17
Alumina	6.01
Ferric oxide	2.60
Lime	65.54
Magnesia	2.72

The company owns 131 acres of limestone land, estimated to contain close to 75,000,000 tons of stone suitable for the manufacture of Portland cement, and it is abundantly supplied with shale, and these materials are sufficient to run



Plant and Quarries of the Maryland Portland Cement Company, Security, Md.

the plant at its present capacity for centuries.

The high silica content provided by nature insures in Security Portland cement a high grade product that will increase in strength as it ages. Silica is a natural retarder, thus the amount of plaster necessary to be added to ordinary Portland cements is less in Security than in some other brands.

Nature has again favored Security Portland cement in the low alumina and extremely low magnesia content, both of these elements appearing in less quantity than in ordinary Portlands.

The construction of this modern and complete Portland cement plant in the United States has cost considerably more than would the ordinary plant of 800 barrels capacity. The high silica properties and tex-

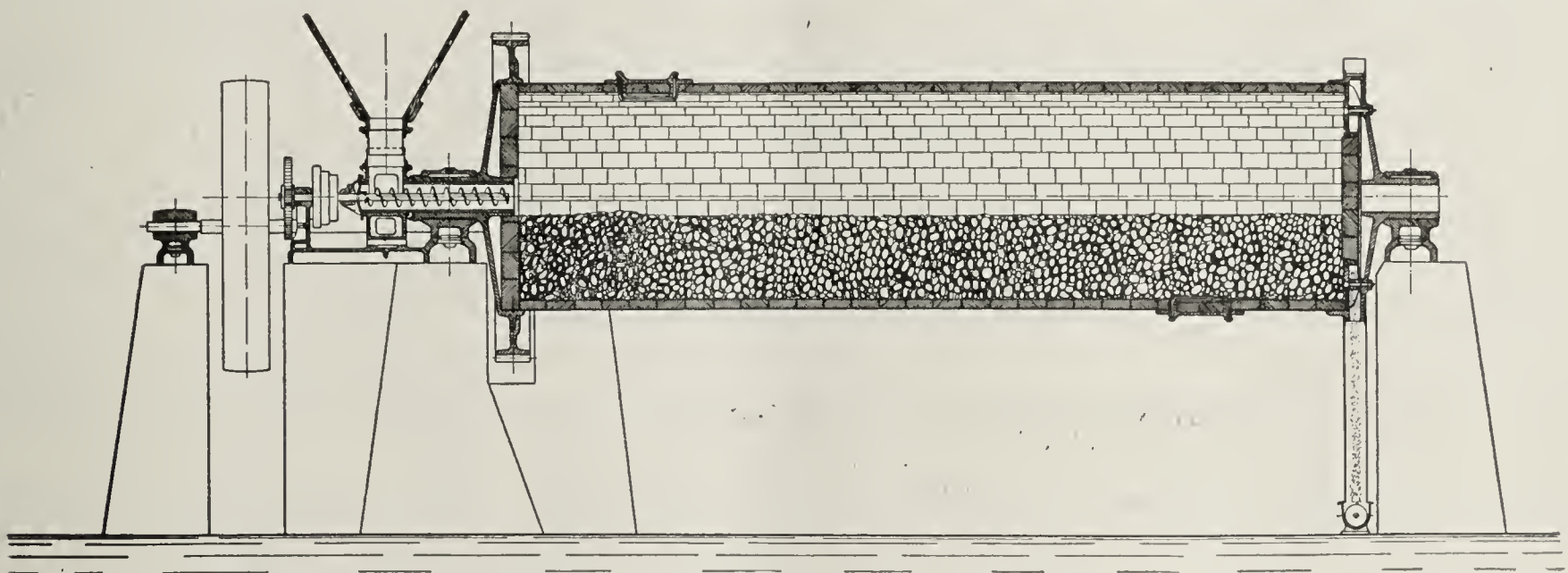
The main sales offices of the company are at 820-822 Equitable building, Baltimore, Md.

The plant was formally opened on July 24 and the occasion celebrated with a sea food dinner in which all the officers and directors of the company, together with county officials and railroad officials joined. Every separate part of the mill had already been tried out, so that when the big engines were started and each successive section of the running load added the whole connected system of mechanism was promptly put into successful operation.

The Practical Cement Crew, Major F. H. Lewis, consulting engineer, member of the American Society of Civil Engineers, Engineers Club of New York, and the Engineers' Association of the South, is

C. M. Goodman, superintendent of works, is a chemist from Pennsylvania University with years of practical experience in the laboratories of several cement plants in the capacity of head chemist. He was assistant to Major Lewis in designing a cement plant in the south, and afterward became its construction engineer. He has been the man in charge of the actual job of construction of the Maryland plant, and consequently is perfectly qualified to make every part of the works to do his bidding.

Harry B. Warner, sales manager, grew up with the Portland cement business at Philadelphia amidst the most favorable surroundings to accumulate his full knowledge of the office and distributing end. He is the man that the dealer in cement, the specifying architect, and in



Davidson Patented Tube Mill installed in the New Maryland Portland Cement Mill.
Manufactured by F. L. Smidth & Co., New York City.

ture of raw material require finest grinding and highest burning—both costly propositions.

Security Portland cement is therefore not a cheaply manufactured product, nor is it a cheap cement, but is manufactured to meet and maintain the most stringent specifications, whether used on the most exacting of public or municipal works, or the small cement walks of a progressive village.

With the localization of the Portland cement business in the United States, it certainly behooves the circumspect dealer to connect himself with the plant which will ultimately command the territory in which he, the dealer, is located.

Co-operation and fair treatment with dealer, architect and contractor, means the ultimate growth of "Security" Portland cement to a daily output of 2,500 to 3,000 barrels a day. It is on this basis that the Maryland Portland Cement Company is conducting its operations.

well known in connection with the development of the Portland cement industry in America. He is a product of Pennsylvania University. His first engineering experience was in railroad work. He twice visited Europe to investigate the Portland cement industry, and has served as consulting engineer for the design of Portland cement plants in Pennsylvania, Virginia, Alabama, and California before taking up the Maryland plant. All of these plants are now in successful operation. He has given the Maryland plant the benefit of all his previous knowledge and experience, and takes no little pride in the youngest offspring of his genius.

J. H. Payne, chemist in charge, hails from Massachusetts Institute of Technology, and is a young man of energetic temperament, and a cement enthusiast as well as expert chemist. His experience in Virginia and Texas Portland cement plants has won for him an enviable reputation.

short the whole consuming world will know as the "Security" man. He has a very wide acquaintance with the trade in his own especial territory as well as throughout the country at large. Blest with a happy disposition, he is universally popular, resourceful and aggressive. He was first secretary of the American Association of Portland Cement Manufacturers, and has always enjoyed the respect and esteem of every member of that body. He is strictly business to the core, and above all knows how to handle cement and cement customers.

Sure the Maryland Portland Cement Company is fortunate in the selection of such an array of practical talent.

NEW PORTLAND CEMENT PLANT OF THE MONARCH COMPANY.

Among the new plants under construction in Kansas is that of the Monarch Portland Cement Co., at Humboldt. This plant is very favorably situated just outside the city

limits of Humboldt. The land is overlaid by a thirty-five foot vein of limestone under which there is an extensive deposit of shale well adapted for use in the manufacture of cement. This property is located in the gas belt and the Co. owns some 6000 acres in the heart of the field adjoining some very large wells. Coal Creek, which runs through the property, furnishes an abundant supply of water.

The plant will be of the most modern design throughout with all the late labor saving devices making it as nearly automatic as possible. The driers for drying the rock and clay will be 7 ft. diameter by 60 ft. long. Eight rotary kilns 8 ft. in diameter by 125 ft. long will be used. The waste heat from these kilns is to be utilized in furnishing steam for power purposes. This arrangement will result in a saving of about one third of the fuel ordinarily required for running such a plant. The plant will have unusual facilities for clinker storage by which the clinker will be thoroughly cured at all times before passing to the grinders. The grinding of both the raw material and clinker will be done by Bonnot Pulverizers.

Both the Sante Fe and the M. K. & T. Railroads cross this property giving excellent shipping facilities. The buildings will be fireproof of steel and concrete construction. The Bonnot Company, Canton, Ohio, are supplying the machinery for this plant.

The Murray Iron Works Company, Burlington, Iowa, are sending to all those interested a three color picture of a Murray Corliss engine mounted on a mat 9x13 inches, ready for framing. This is a very handsome picture and on receipt of same it found a place in our office immediately.

RAPAUNO WORKS OF THE DU PONT POWDER COMPANY.

Quite a large party of representative men from the Wyoming and Lehigh anthracite regions recently visited the Rapauno Works of the E. I. du Pont de Nemours Powder Company, at Gibbstown, N. J., to witness the methods used by the du Pont Company in testing explosives. The party were guests of the du Pont Company and went by special Pullman cars attached to the Jersey Central train starting from Scranton at 7:10 A. M. Additions to the party were made in Wilkes Barre, White Haven and Mauch Chunk, and in Philadelphia a number of representatives of the du Pont Com-

pany joined the party. Two special cars were provided, a Pullman and a combination diner and buffet car, and en route breakfast and supper were served.

The members of the party from the Wyoming region were in charge of Mr. F. L. Belin, assistant to the president of the E. I. du Pont de Nemours Co. of Pennsylvania. The Lehigh members were watched over by Mr. F. W. Stark, manager of the Hazleton office of the company. At Philadelphia, the party were joined by Mr. Charles L. Patterson, vice-president sales department; Dr. Charles L. Reese, chief chemist; Mr. F. H. Gunsolus, manager technical division, and other representatives of the du Pont Company.

The train reached the Twelfth and Market Streets Station, Philadelphia, at noon, and from here automobiles conveyed the party to the Race Street wharf, where the private yacht of Mr. T. C. du Pont was boarded. The trip down the Delaware from Philadelphia to Gibbstown was most delightful and gave an excellent opportunity for seeing the Philadelphia river front and harbor. During the river trip luncheon was served, so that upon reaching the Gibbstown wharf at 1:45 the party went immediately to the assembly room of the experimental laboratory, where Doctor Comey, chief chemist in charge of the experimental laboratory, explained the different methods of testing explosives, and outlined tests that were to be shown the party.

It should be stated in passing that before the party landed from the yacht, request was made that all matches be given up as none are allowed within the works. The Repauno Works are the largest exploded within the works. The Repauno occupy a tract of some 1,200 acres stretching along the Delaware for a mile or more. Other spots in New Jersey are more frequented by excursionists than this, because it is not generally open to visitors, and visitors with sensitive nerves are not attracted by it, for dynamite, nitroglycerine, and many other forms of high explosives, many of them with unpronounceable names are being trundled about apparently with as little thought of danger as in an ordinary factory. Upon closer inspection, however, it will be found that every precaution to avoid accident is being taken, and what seems to be, at a distance, an ordinary wheelbarrow or truck is found instead to be rubber tired, similar precautions being taken throughout.

After the preliminary explana-

tion, the company was divided into two parts for convenience in visiting the testing station.

The testing methods shown were:

1. The ballistic-mortar test, for showing the strength of powder in foot-pounds.

2. The Trauzl lead-block tests, for showing the strength of the explosive by means of the increased size of hole made in a lead block when an explosive is fired.

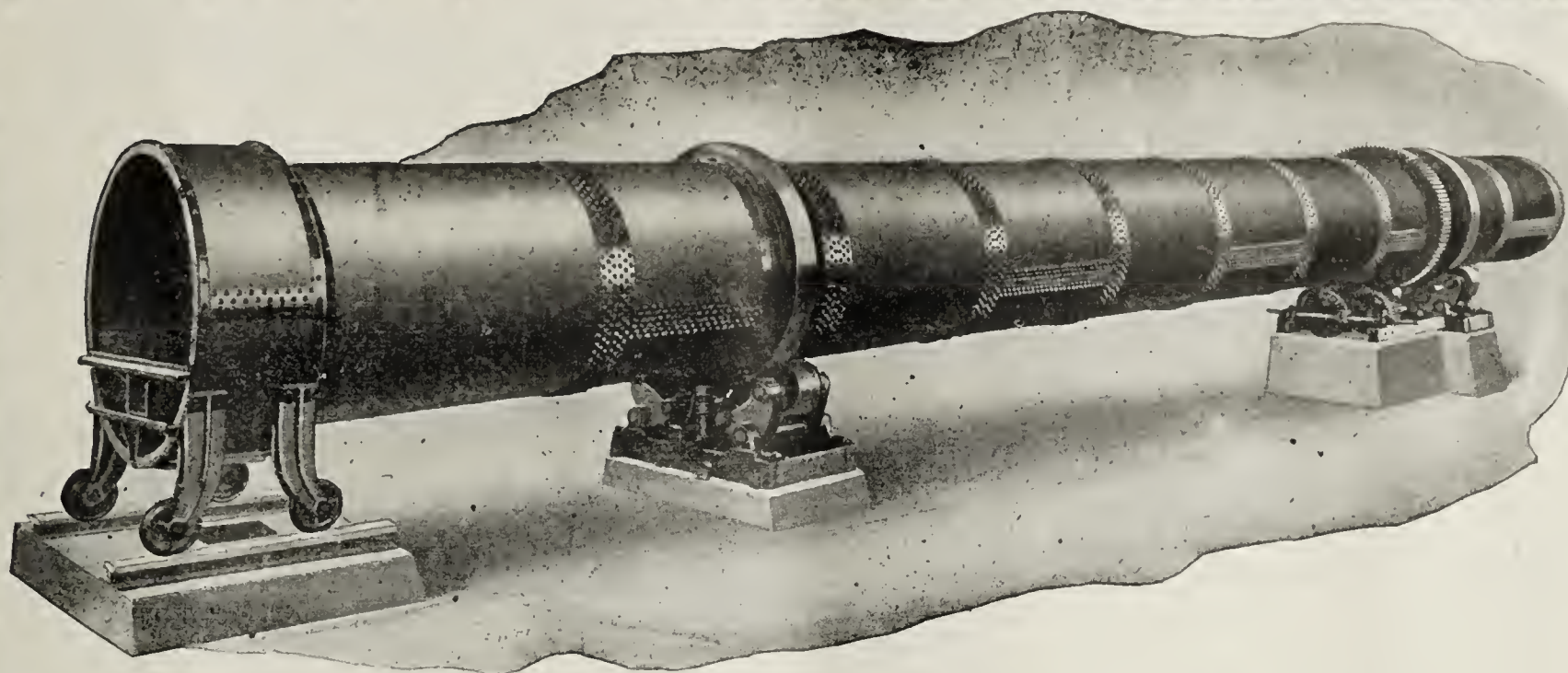
3. The druckmesser or pressure gauge shown by a chart attached to the cyclinder in which the explosion occurs the pressure of the gases resulting from an explosion both at the high temperature of the explosion and after they have cooled; it also affords means for securing the gases resulting from the explosion for subsequent analysis. A large calorimeter connected with this same part of the testing station allows the heat resulting from an explosion to be accurately determined.

4. By means of the lead-block test the effect of an explosion is shown by the shattering and change of shape of a lead cylinder upon which the explosive is placed and exploded.

5. Probably the most interesting test was the photographic apparatus used for determining the length and duration of flame from an explosion.

The tests made a great impression upon all the visitors, as showing the care taken by the du Pont sives before putting them upon the market. The testing station also showed the great expense to which the company is put and which does not show in ordinary manufacturing costs, as at the experimental laboratories in Gibbstown thirty chemists are constantly employed upon purely experimental work. This experimental work is entirely separate and distinct from the routine chemical and testing work done in connection with the manufacturing plants of the company throughout the country and is one of the fixed charges from which no direct return is secured excepting in the guarantee given to the buyer of the explosive, that every effort is being made to produce the most efficient possible blasting material.

The city of Joliet, Ill., located in the largest limestone producing district in the United States has decided to use concrete curbing. Joliet has supplied most of the street curbing used in Chicago during the past 35 years.



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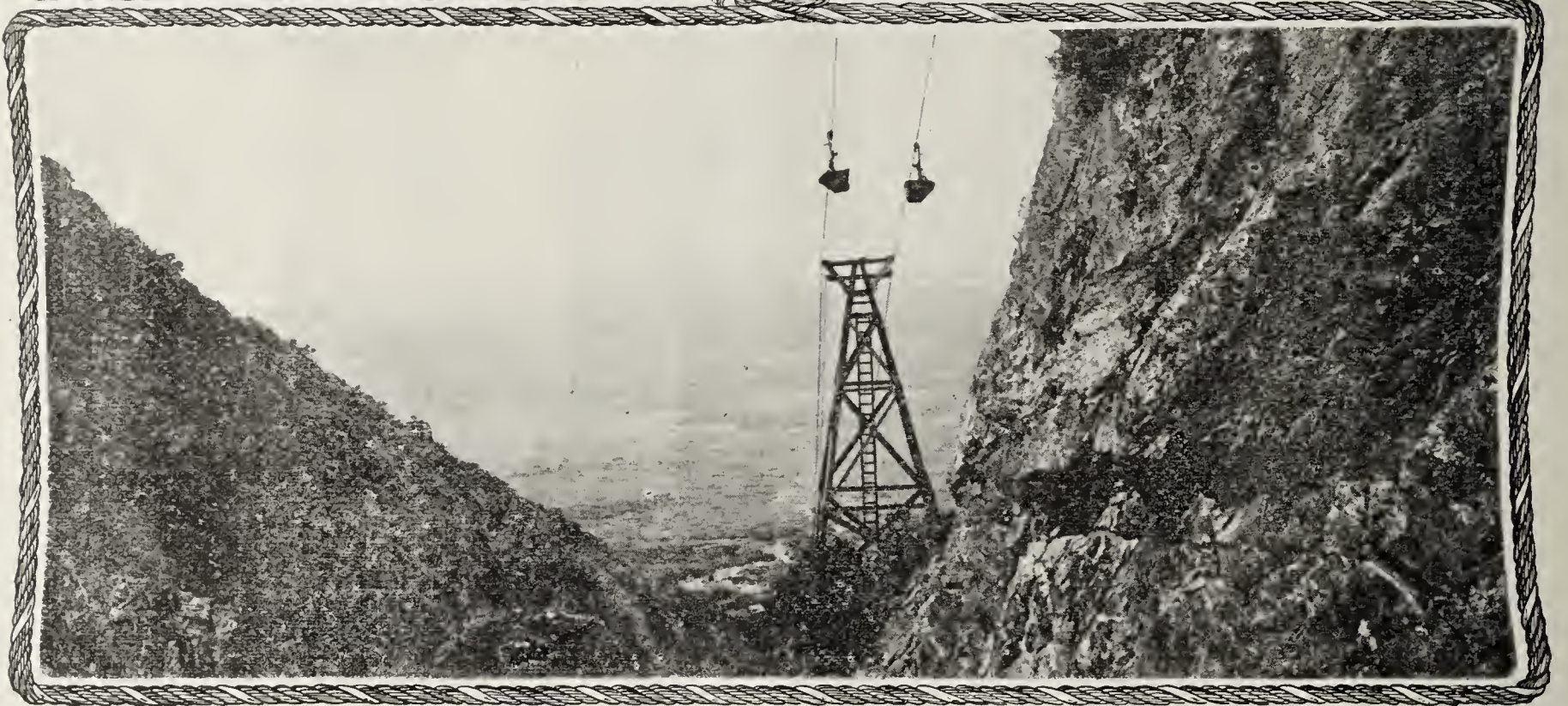
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Second Annual CEMENT SHOW

Coliseum, Chicago, February 18-24, 1909

UNDER THE MANAGEMENT OF THE

CEMENT PRODUCTS EXHIBITION CO.

The Principal Gathering of the Cement Trade in America

The CEMENT AGE said about the First Annual Cement Show in Chicago:

"The Exhibition was held from December 17-21 inclusive, and an estimate of the attendance may be conservatively placed at 25,000 daily. The visitors seemed to hail from everywhere. Concrete block makers from Mexico were in attendance, as were contractors from Spain and manufacturers from Germany. The number of exhibits surpassed all previous records. It is said that the manufacturers represented closed business to the amount of \$3,000,000."

Make your preparations now to be in attendance. Exhibitions of cement products, cement and concrete machinery, reinforcing materials, coloring mixtures, waterproofing compounds, fireproofing systems, aggregates, publications, or of anything else connected with the cement industry, may enter applications for space. Requests for application blanks and diagrams should be made promptly as the entire floor space promises to be taken upon the first allotment.

Address all Communications to—

Cement Products Exhibition Co., Commercial Bank Building
CHICAGO

PERFECTION IN BLOCK MAKING

If you wish to attain this you should combine these three important features:

WET PROCESS FACE DOWN

DAMP CURING TRIPLE STACKING

The **PETTYJOHN INVINCIBLE MACHINE** does this, and is the only machine that does. Tandem Invincible makes two blocks at once. Price, \$65 and up. Single Invincible, \$35 and up. With our **Triple Tier Racking System** green blocks can be stacked three high direct from the machine with inexpensive home made rigging. Plans and blue prints free to customers. It economizes space, reduces off-bearing distance and above all insures slow, even, damp and perfect curing and bleaching.

Write for our latest edition of "Stone Making," a book of valuable data, just off the press.—**Free.**

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INCLUDING FURNACE, PIPE, FITTINGS, REGISTERS.



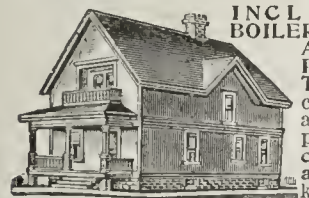
Everything complete for installation, according to our simple plans and diagrams.

WE CAN SAVE YOU AN IMMENSE AMOUNT OF MONEY on any kind of a heating plant—furnace, hot water or steam—installed under our binding guarantee of satisfaction or MONEY REFUNDED.

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STEAM OR HOT WATER HEATING PLANT FOR THIS HOUSE \$125⁰⁰



INCLUDING BOILER, RADIATORS,

PIPE, VALVES, FITTINGS, and everything complete for installation according to our simple plans and diagrams. We can save you an immense amount of money on any kind of a heating plant,

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A STANDARD PORTLAND FOR UNIVERSAL USE



Daily Output 17,000 Barrels
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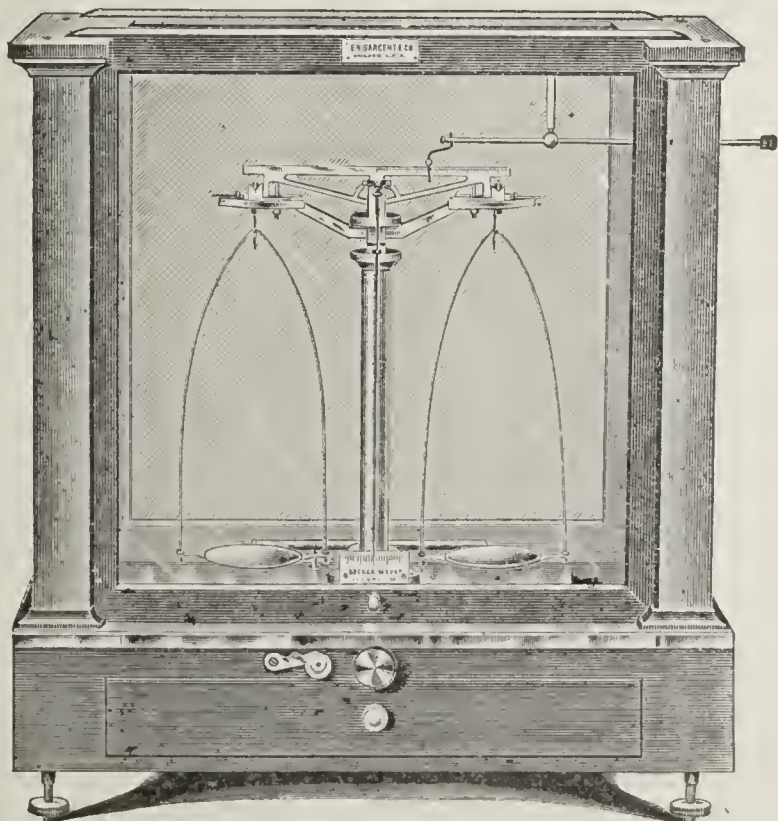
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We send catalogue without charge to responsible parties.

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When you buy a mixer see that it is a **Koehring**, the mixer that can be relied on for
Perfect Mixed Concrete and Durability

Made with

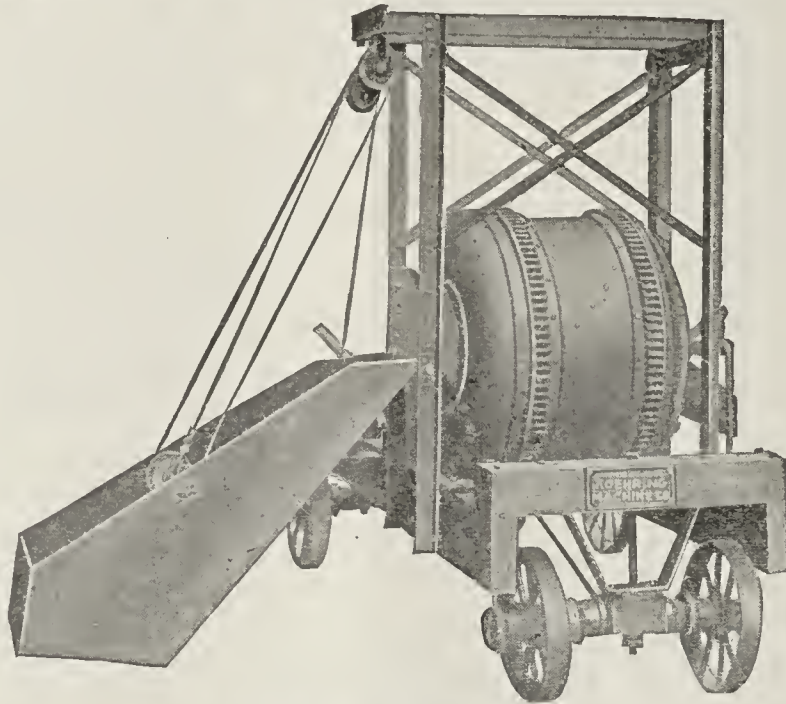
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of Heavy Pattern.

Steel Pinions

All Wearing Parts are
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Runway rollers are
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**Quick
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**No Spilling
Lowest
Charging
Chute**

Has cast iron heads and
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Mixes concrete at less
cost than any other mixer

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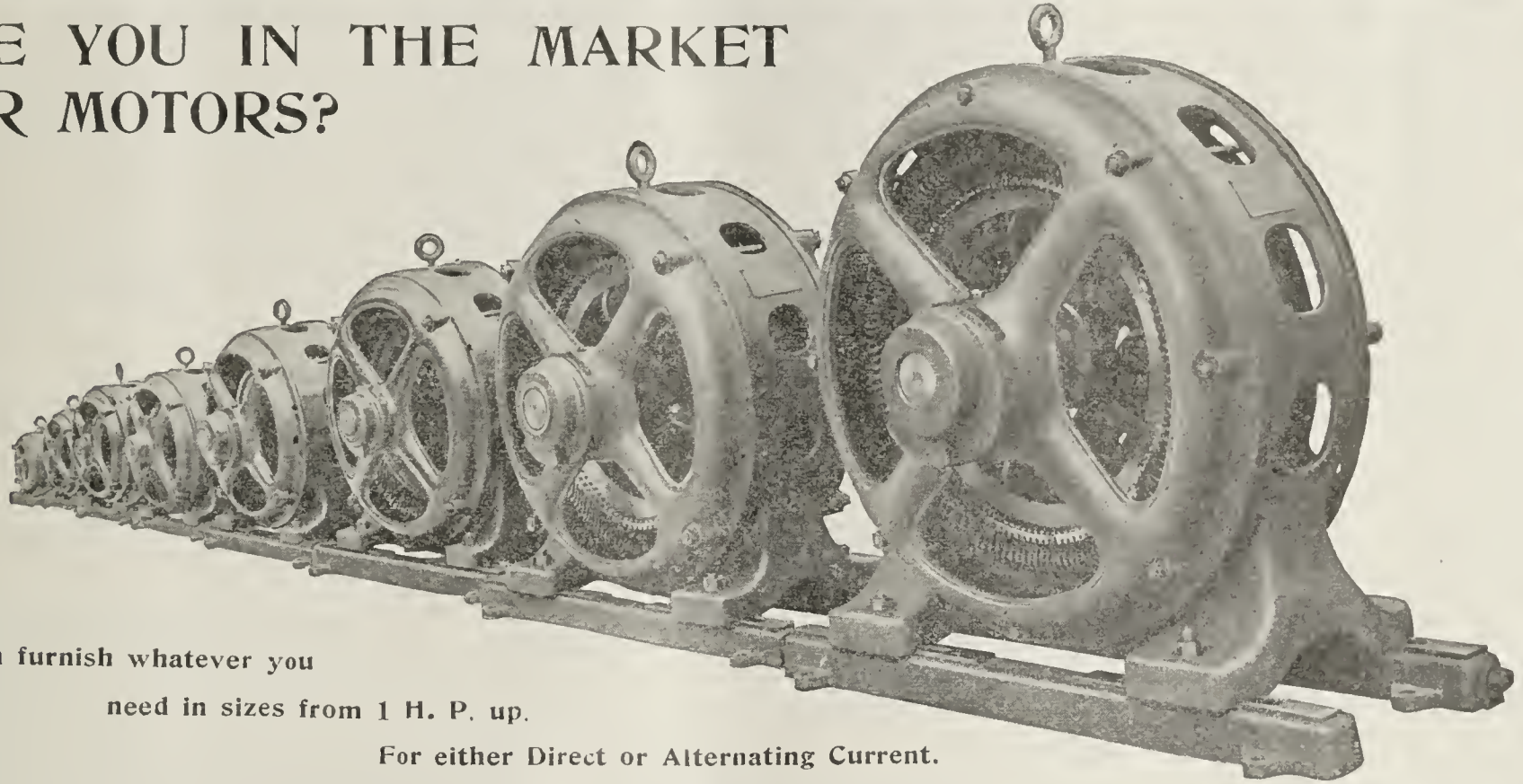
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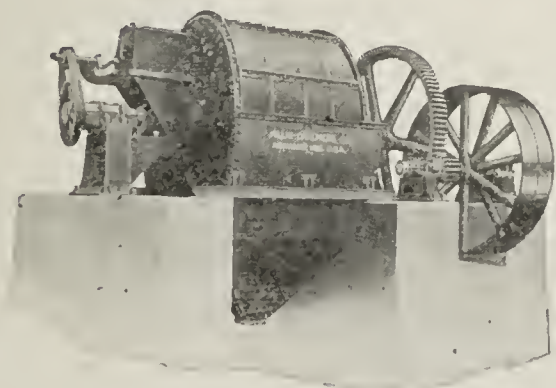
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for every stage by either Wet or Dry Process

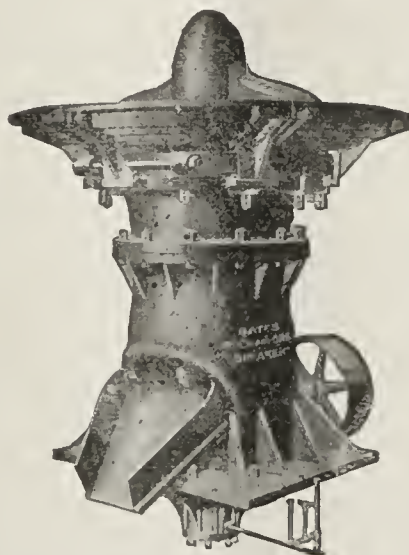
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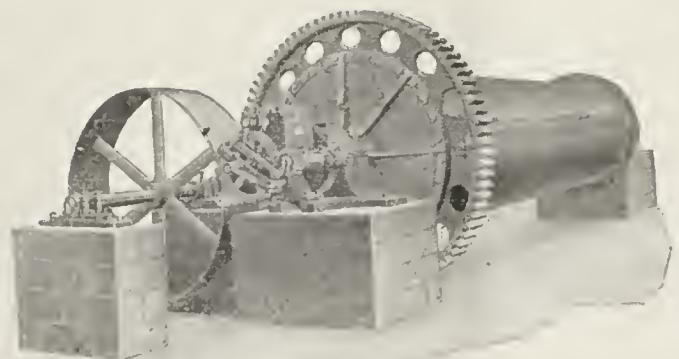
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Ball Mill with Feeder Attached



Style "K" Breaker



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Power and Electrical Machinery of Every Description, Air Compressors

Revolving and Stationary Screens, Perforated Metal of All Kinds, Feeders, Belt Elevators, Belt Conveyors,
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No lime used.

Absolutely waterproof.



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Why not get our book. A postal card will bring it to you.

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Chicago

ARCHITECTS' AND ENGINEERS'
HANDBOOK OF

Re-Inforced Concrete Constructions

172 pages.

Illustration and Diagrams 217 pages.

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Cloth, \$2.50, Paper, \$2.00,

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Cement and Engineering News

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Experts in the Designing of
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HEINE WATER TUBE BOILERS

Are used in many Cement and other plants requiring high pressure steam.

Admirably adapted to the use of any fired and any method of stoking.

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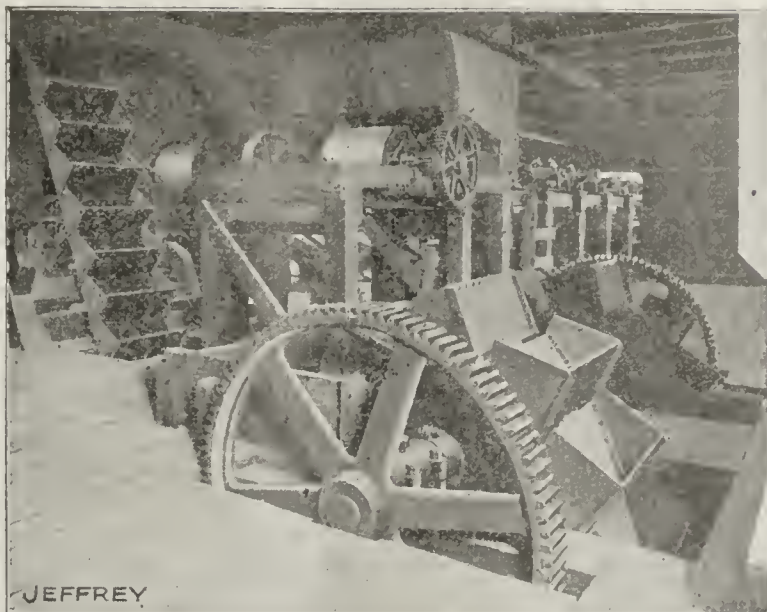
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WANTED—Position by skilled chemist with technical training and six years practical experience. Address Box A, Care of Cement & Engineering News.

FOR SALE—Fire and damp-proof floor and wall plaster, my composition; also rights of making imitation cut stone for building stone, on a cheap process. Address J. Ruoff, 3053 Rorer St., Philadelphia, Pa.

CHEMIST With 6 years' extensive and successful experience with wet and dry processes, desires change of location. Have used all cement materials and fuels. References from past and present employers. Address M. M. B., care Cement & Engineering News.

Mechanical Engineer, member American Society of Engineers, 14 years' broad experience in both civil and mechanical engineering.. Last four years, manager and superin-



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Elevators and

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Stone Co.,
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Overlapping Pivoted Bucket Carriers

Spiral Conveyers, Coal Crushers, Pulverizers, Conveying Machinery
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tendent of cement plants, is open for position as above, or will contract to design and superintend the erection of cement plants on a percentage basis, guaranteeing production and manufacturing cost by

operating plant for one year as manager after completion, and forfeiting 40 per cent of engineering fee on failing to make guarantee.—L. L. Griffiths, Consulting Engineer. Box 793, Bedford, Ind.

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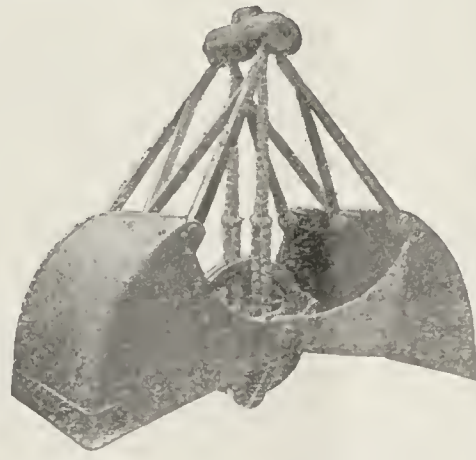
are known for their great capacity and ability to give continued satisfaction under all conditions.

We know what digging buckets should be and build them to meet every emergency.



OUR 1908 TYPE

has many advantages over all other makes



Our new Scraper Bucket, cut of which is shown in reading pages of this issue was selected from many others for use at the plant of the Meramac Portland Cement Co.

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(COPY)

April 6, 1908.

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Replying to your communication of the 2d, our Griffin Mills are giving us perfect satisfaction. We are using these mills on Portland Cement clinker and are grinding to a fineness of 95½ through 100, using a 40 mesh screen. We are averaging from 5½ to 6 barrels an hour per mill. We trust the above will answer your inquiries.

Yours very truly,

May we have the privilege of referring you to cement grinders who will convince you regarding its merits?

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LONDON OFFICE: 37 Walbrook, E. C.
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FOR

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Zeigler Coal
is the best

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Low in sulphur 1-2 of
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Uniform Ash
Low in moisture.

At your request our Sales Agent and Chemist will call on you.

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ZEIGLER COAL CO.

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Estimates furnished for
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LATHBURY & SPACKMAN, Inc.**Consulting Engineers and Experts**For the Erection, Designing and Operation
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You Need**"General Specifications for Con-
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inches, flexible cover, 46 pages.**Price, 50 cents, net****"General Specifications for Con-
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neer of wide experience, is well
known and has a high standing
professionally. It is doubtful if
any man is better qualified to
produce books of this nature.

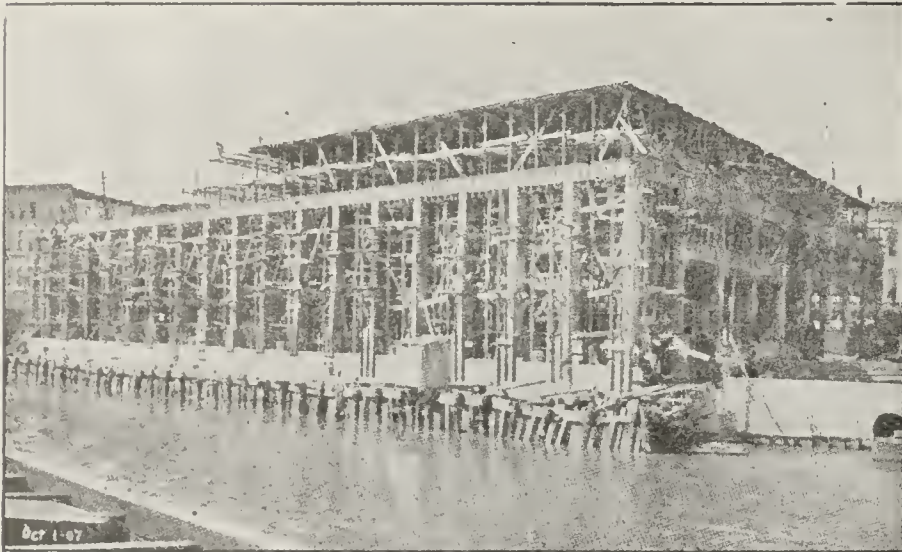
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Cement and Engineering News

22 Fifth Avenue, - - Chicago, Ill.

MEDUSA WATER-PROOF COMPOUND

Makes all concrete watertight



The foundations and floor in basement, all of cement, in the Bostwick-Braun warehouse, Toledo, O., here illustrated contain Medusa.

Write for pamphlet describing its use.

Do not accept a substitute, as there are many adulterated compounds on the market.

Sandusky Portland Cement Company
Sandusky, Ohio

Write for free samples of our White Portland Cement



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Concrete Manufacturers

YOUR HARVEST SEASON IS SOON TO OPEN.

Are you equipped to get all the profitable business in your line? Take sewer pipe. \$34.50 will equip you with a 15" bell and pipe mold. This size is mostly used by road supervisors for culvert work. The profits on one hundred foot of his pipe sold at clay prices will pay for a mold. This is certainly worth investigating. Had you not better send your order for a 15" size today?

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PAUL O. COOK, Proprietor

Clarinda, Iowa, Dec. 17, 1906.
Miracle Pressed Stone Co., Minneapolis.

Gents:—The tile molds I find to be just the thing. We had a good sale of the tile, it was late in the year to buy these tile molds but we had a good trade. We made about 3000 ft. of 12 in. tile; 2500 ft. of 15 in. tile; and about 1500 ft. of 25 in. tile. I think they are better than clay tile. They will stand frost better, and the older they get the better they are. A clay tile is no better than the day it is put in the ground—cement gets better the longer it is in the ground. I know this to be true; I have made clay tile for 16 years and am still making them.
Yours
PAUL O. COOK.

Miracle Pressed Stone Co.,
Largest Manufacturers of Concrete Machinery in the World
MINNEAPOLIS, U. S. A.

Limestone and Shale

FOR MANUFACTURE OF

Portland Cement

ON THE

Illinois Central Railroad

IN THE

West and South

Coal, Water and Good Labor

For Full Particulars Address

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Industrial Commissioner, I. C. R. R. Co.
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MANUFACTURERS OF THE ATLAS DRYERS

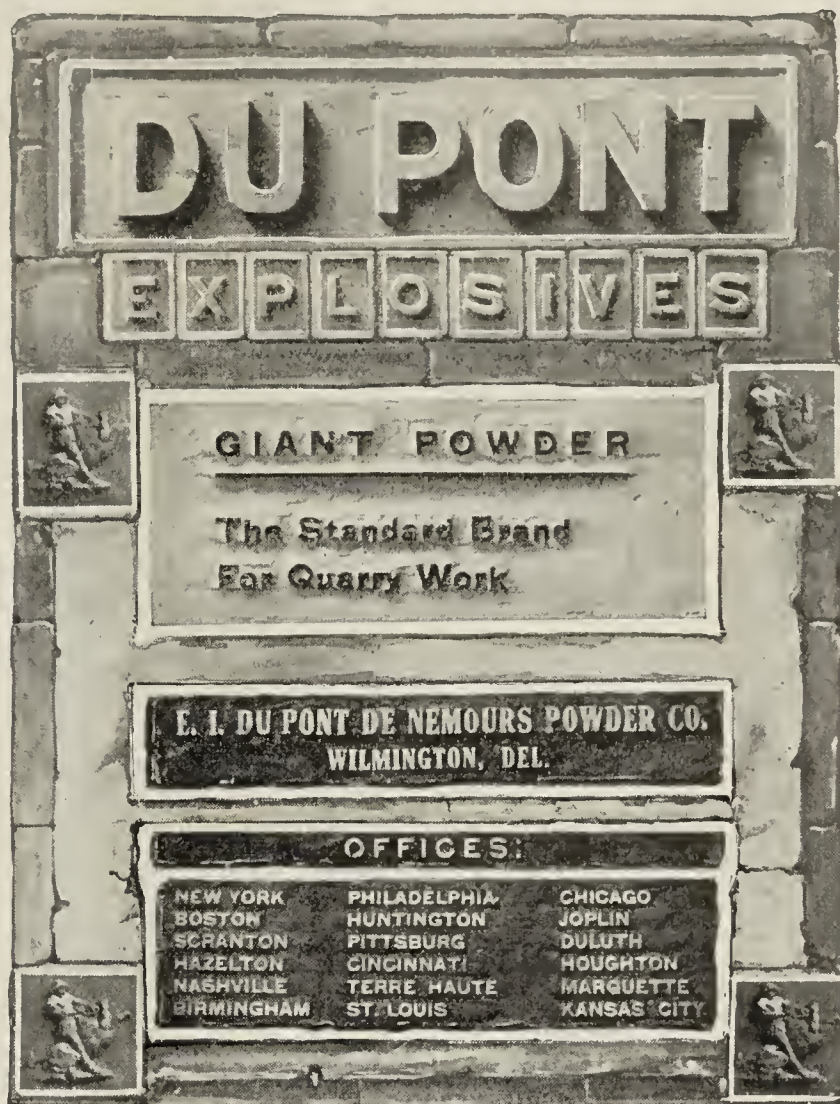


A GOOD MONEY MAKER

This portable Vacuum House-cleaning machine will earn from \$25 to \$50 per day—expenses about \$6.00. Latest and best method for cleaning carpets, rugs, upholstery, draperies, etc., without removal from the house. Sucks out the dust into tanks in the wagon. In big demand the year 'round for homes, churches, theatres, halls, stores, etc. A clean, legitimate, independent business, at good prices, netting from \$3,000 to \$5,000 per year to hustling men with about \$3,000 capital. Some customers are operating as many as four outfits. Exclusive territory with practically no competition or risk. We help you get the business. Descriptive literature to responsible parties with necessary capital.

We also install stationary vacuum cleaning plants in residences and public buildings of all kinds.

American Air Cleaning Co.
Milwaukee, Wisconsin



Peerless Portland Cement

MANUFACTURED AT UNION
CITY, MICH.

**Every Barrel
Guaranteed**

Fineness, Uniformity of Color
and Sand Carrying Qualities
equal to any Portland Ce-
ment Manufactured

When You Build Use Concrete

It is economical, durable, fireproof and sanitary; needs no paint or repairs, is warmer in winter, cooler in summer than any other construction and is adaptable to any type of

Factory, Warehouse or Mill

We have prepared for Manufacturer and Merchant a new book dealing solely with the important question of factory building.

"Reinforced Concrete in Factory Construction"

a book containing, besides several general chapters on concrete, concrete aggregates, methods and materials for reinforcing—ten chapters giving detailed description of ten Concrete Factories and Warehouses erected in various parts of the country by different systems. The photographs, sectional drawings, and specifications for this book were furnished by the engineers in charge of the work.

This book, profusely illustrated [250 pages, size 6½x9], pamphlet bound, sent free upon request to Architects, Engineers and Manufacturers, who contemplate building.
Cloth bound copies 50 cents each.

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For the Suburbanite and Farmer:

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THE ATLAS PORTLAND CEMENT COMPANY

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30 Broad Street, New York

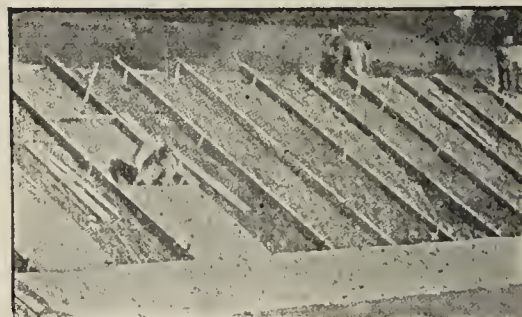
CONCRETE WATERPROOFING



For Use between Layers
of Concrete



Also Expansion
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SHOWING METHOD EMPLOYED FOR WATERPROOFING CONCRETE RESERVOIRS

"Pioneer" Waterproofing Asphalt

The only genuine Waterproofing Asphalt Made--NOT Manufactured from 'Oils'
—But from Pure Asphaltum obtained from Our Own Mines

Difficult Installations Our Specialty

AMERICAN ASPHALTUM & RUBBER CO. CHICAGO, ILL.

Location for Cement Plant

Extensive Deposits of Raw Material. Proximity to Large and Growing Markets. Low-Priced Fuel Supply.



THERE ARE several desirable locations for Portland Cement Plants along the Santa Fe, where the advantages enumerated are to be found. If you are interested you can secure full and detailed information by addressing this office.

The SANTA FE is glad at all times to co-operate with those seeking locations or desirous of investigating conditions in territory tributary to its line. Correspondence from interested manufacturers is invited.

WESLEY MERRITT, Industrial Commissioner A., T. & S. F. Ry.
1122 Railway Exchange Building CHICAGO, ILL

Wet Process Concrete Blocks

By the Pettyjohn System

The manufacturing of Concrete Blocks is rapidly nearing perfection, but the up-to-date manufacturer must use modern machinery and employ improved methods. Three features are important in perfect block making:

Wet Process

Face Down

Damp Curing

These splendid features are combined in the new Pettyjohn Invincible Machine, and no other. Made in three lengths 16-inch, 24-inch and 40-inch. Tandem Invincible makes two blocks at once. Price \$65 and up. Single Invincibles, \$35 and up. Sold on trial always, guaranteed to give satisfaction or money refunded.

With our **TRIPLE TIER RACKING SYSTEM** green blocks can be stacked three high direct from machine with inexpensive home-made rigging. This economizes space, reduces off-bearing distance, and above all insures slow, even, damp, perfect curing and bleaching. Plans and blue prints free to customers.

Send for our latest edition of "Stone Making" (just published), a book of valuable data for the block maker—FREE.

THE PETTYJOHN COMPANY - = 645 No. Sixth St., Terre Haute, Ind.

CEMENT

.....AND.....

ENGINEERING NEWS



SUN DIAL

Executed by the Tiffany Studios, New York
Made with Berkshire "Snow White" Portland Cement

See Page 285

CEMENT AND ENGINEERING NEWS

(PUBLISHED MONTHLY)

WILLIAM SEAFERT, Editor and Publisher

OFFICE—22 Fifth Avenue

Cable Address—"Seafert," Chicago.

Entered at the Post Office at Chicago, as
Second-class matter, July 21, 1896,
under Act of March 3d, 1879.

Subscription, . . . \$2.00 Per Year
Foreign Subscription, . . . 2.50 Per Year

Advertising Rates Sent on Application

JOHN F. WALDRON, Advertising Manager

CHICAGO, NOVEMBER, 1908.

CORRESPONDENCE.

We solicit correspondence on all matters of general interest to the cement trade in all its branches. Engineering notes, public improvements, and facts and opinions drawn from practical experiments will be welcome.

CEMENT CONVENTION DATES.

The National Association of Cement Users' Fifth Annual Convention at Cleveland, Ohio, January 11 to 16, 1909, Exhibition Hall, Central Armory. Convention Hall, Hotel Hollenden.

Cement Products Exhibition Co., 2nd Annual Cement Show, February 18 to 24, 1909, at the Coliseum, Chicago.

Northwestern Cement Products Association Exposition, March 2, 3, 4, 1909, at The Armory, Minneapolis, Minn.

EDUCATIONAL FEATURES OF CEMENT CONVENTIONS.

There are now three thriving Cement Users' Associations in the United States, inter-state in scope and membership, as follows: The National Association of Cement Users, the Cement Products Exhibition Co. and the Northwestern Cement Products Association. Each of these organizations is designed to promote the use of Cement Construction along sound and practical lines, in order that its use may not fall into disrepute, and especially to interest inexperienced cement contractors in the proper use of cement. The Cement Industry has experienced such a rapid growth that many new contractors are required to meet the demand in widely distributed areas, where the experienced contractor has not yet penetrated. Every city, town, and hamlet in the country now makes use of cement in public and private improvements; each and every one of these municipalities are and must be directly interested in attending these cement conventions, in order to learn correct and economical uses of cement and thus avoid failures. These cement conventions with their exchange of ideas by practiced experts have done much to correct shoddy methods of construction among those who make it a point to attend the conventions. These inex-

perienced men go home with new ideas which they employ in their next season's work, and thus give better satisfaction to their customers, and have fewer complaints against the cement mills about bad cement. The uniformly high grade American cement now on the market will produce sound work if properly handled. The cement machinery exhibits which form a part of these exhibits, enables the contractor to study under a single roof, the various machinery in operation from which he may select just what he needs. Here the machinery manufacturers, and the consumer meet on common ground. Here the latest devices produced since the interval of last year's conventions will be displayed. Therefore the cement contractor who wishes to be in line with up to date methods, must attend these conventions as a school of instruction to help him in next season's work. Our advice is, don't miss a convention if you want to keep at the head of the line in construction work of any kind, it will be best means of putting money in your purse. The best brains and interests in the cement industry will be on hand to greet and instruct you in the exact line of your work. A man might as well go out of business as be out of date in his line of calling. Come to the Cement Convention, and see what your fellow craftsmen have accomplished. A week at the cement exhibit will yield you more practical knowledge than years of going it blind and alone.

"It's an ill wind that blows nobody good," is an old saw, but true sometimes. When cement prices went glimmering and profits disappeared the management of the Bates Valve Bag Company felt as blue about it as the cement men themselves. They soon found however that with manufacturers sharpening their pencils to play even and keep the plant running their proposition of one-half to one cent per barrel gain in the packing department was more attractive than when manufacturers were getting big profits.

We do not wish to be understood as saying that a cent a barrel is not worth saving at any time, but it certainly does look bigger when the juice is all squeezed out of the cement profits by low prices. We hazard the prediction that a cent per barrel will look bigger and bigger as we go along with all the new plants turning their output into the already overcrowded markets.

The latest additions to the list of those who pack by the Bates System are the Texas Portland Cement Co., Dallas, Texas, Vulcan Portland Cement Co., Montreal, Canada, and

Alsen's American Portland Cement Co., Alsen, N. Y. The Edison Portland Cement Co., have decided to try the machines at their plant at New Village, N. J.

The Hayward Company, 50 Church street, New York, shows in a handsome catalog of 152 pages their orange-peel and clam shell buckets, as well as many types of machines by which they are operated. In doing this they have not confined themselves to machines of their own manufacture, but have illustrated derricks, cranes and other plants built by reputable concerns, for the purpose of showing the application of the Hayward buckets to any hoisting apparatus. The greater part of the catalog is devoted to dredges, excavators, derricks and coal handling machinery of their own manufacture, but is not a complete list of the machines they build, for the reason that special machines are necessary for certain kinds of work. The Hayward line is stated to be adapted to every variety of dredging and excavating, grading and ditch digging for railways; dredging and deepening canals and harbors; excavating and dredging canals and sewers; sinking cylinders and caissons for bridge piers; well sinking and ore bed digging; rock, broken stone, and phosphate dredging, and placer mining and cellar digging. The new sand and gravel plants of the Meramec Portland Cement and Material Company, located near St. Louis, Mo., is equipped with Hayward patented buckets.

A NEW CEMENT BRICK MACHINE.

The Hudson Manufacturing Co., Hudson, Ind., have placed on the market a new cement brick machine. The following is what they have to say regarding this machine: "Our Brick Machines are simple in construction and operation although efficient and durable. They are constructed of the very best material throughout and are made to stand the test of hard usage as well as to turn out a first-class brick. The body of the machine is made up of five parts, all of them substantial and made to do the work."

"Our machines all have the drawn divides, insuring against broken corners and saving a great deal of back breaking work. These divides are also made of best material and in working they cannot become wedged out of place. Your brick will always be perfectly true and square."

"You can use either iron or wood pallets with these machines. We recommend the use of iron pallets, as the brick are not so liable to crack

through the center as with wood pallets; however, wood pallets do very well and you will have good success with them if they are properly taken care of.

"Our No. 1 Machine makes ten brick at a time and has a foot lever for drawing all the divides at once. This machine is furnished with an iron stand and hopper. We claim this machine to be superior to any other on the market, although other machines may sell for twice as much. This machine will easily turn out 4000 perfect brick per day and is unequaled for contractors and dealers in Cement Blocks and building material.

"Our No. 2. Machine makes ten brick at a time, but has hand drawn divides. It does work equally as good as the No. 1 machine but not quite as fast. Will make from 2000 to 3000 per day. It is furnished with Hopper and Wooden Stand.

"Our No. 3 Machine makes five brick at a time and has hand drawn divides. It is made on the same principle as the No. 1 and 2 machines and does the same good work. With this machine one man can make from 1000 to 1500 first class brick per day. This makes a good cheap machine. It is furnished with Hopper but no Stand."

An issue of \$900,000 in 15-year 7-per cent gold bonds has been put on the market by the Acme Portland Cement company to raise funds with which to build the proposed big cement plant on the south shore of Pend Oreille lake.

All of the preferred stock of the company, amounting to \$300,000, was subscribed several weeks ago by some of the first stockholders in the company. It was at first thought that some of the common stock would be converted into preferred and sold, but this plan was abandoned and the bonds will be put on the market soon.

Common stock is being given as a bonus with the bonds. The first \$200,000 of the bonds will carry a 100 per cent bonus in common stock. That is for every \$100 worth of bonds bought the purchaser will receive \$100 in common stock.

Some of the common stock in eastern cement plants is paying from 10 to 35 per cent in annual dividends. The Cement Engineering Co., Aman Moore, president, Los Angeles, Calif., will be the engineers for the plant.

Berkshire "Snow White" Portland Cement is manufactured at Clayton, Mass., in the heart of the Berkshires, from pure white materials which con-

tain all the elements necessary for the manufacture of a high grade true Portland cement.

The materials used are pure white calcite and pure white clay, containing lime silica and alumina in uniform and correct proportions. The process of manufacture is identical to that employed by Portland Cement manufacturers of the highest standard, the only exception being that the rotary kiln is heated by an oil flame instead of using pulverized coal which would stain the raw material, and the absence of iron oxide, the place of which is taken by an additional amount of alumina.

No other such deposits of this excellent raw material are known to exist except in very small and limited quantities. All other non-staining and so-called White Portland Cements, are manufactured from different materials.

Silica, SiO_2	24.26
Alumina Al_2O_3	8.50
Lime CaO	63.60
Sulph. Anhr. S. O.,	.80

TENSILE STRENGTH

24 hours Neat	300
7 days Neat	550
28 days Neat	650
7 days 3 to 1 sand.....	200
28 days 3 to 1 sand	300

THE WILLIAMS NEW UNIVERSAL MACHINE.

The cut shown below illustrates an exterior view of the new Williams Universal Grinder. This machine is of the celebrated hammer type made by the Williams Patent Crusher and Pulverizing Co., Old Colony Building, Chicago. The Williams Co. have manufactured this type of machine for over eleven years, having about 1,400 machines in operation at the present time.



Rockefeller Residence, Greenwich, Conn. Entire House stuccoed with Berkshire White Portland Cement. Architects, His s & Weeks, New York.

"Snow White" Portland Cement manufactured by the Berkshire White Portland Cement Company, Vulcanite Portland Cement Co., Albert Moyer, manager, Flat Iron Bldg., New York, N. Y., sole sales agent, is guaranteed to be a true Portland cement in every particular, standing boiling test and all other tests which are designed to indicate a high grade Portland cement.

ANALYSIS AND AVERAGE TEST

Color	Pure White
Fineness .....No. 100 Sieve	95%
Fineness .....No. 200 Sieve	83%
Set.....Initial 1 hour and 30 min.	
Set.....Final 5 hours	
Boiling. Steam	Good
Air Pats	Good
Magnesia— MgO	.65

The new machine has been on the market but a few years, although it has been very successful in its operation, and is a most economical and useful machine for the cement trade. This machine is used in the raw material end of the Portland cement plant, handling limestone, shale, clay, or coal, preparing them for the tube mill. The No. 3 is the standard size. This machine will take $1\frac{1}{2}$ -inch dry raw material, as mentioned above, and reduce same ninety-five per cent through twenty mesh, giving an excellent tube mill feed. The capacity of this machine ranges from 700 to 800 barrels per twenty-two hours, the horsepower, from forty-five to fifty. It will be readily seen that this machine gives an enormous capacity per horse power, and on

tests that have been run in various plants, the cost of grinding per ton ranges from 2/10 of a cent to 5.10 of a cent, which is very low per barrel, sometimes running as low as 7-100 of a cent per barrel.

These machines have been in operation in the German-American Portland cement plant for several years, preparing all of the raw material that is used in this plant for the tube mills, they are also an important installation in the new Dixon, Ill., plant of the Sandusky Portland Cement Co., and are used very extensively in all of the new plants that are building throughout the west.

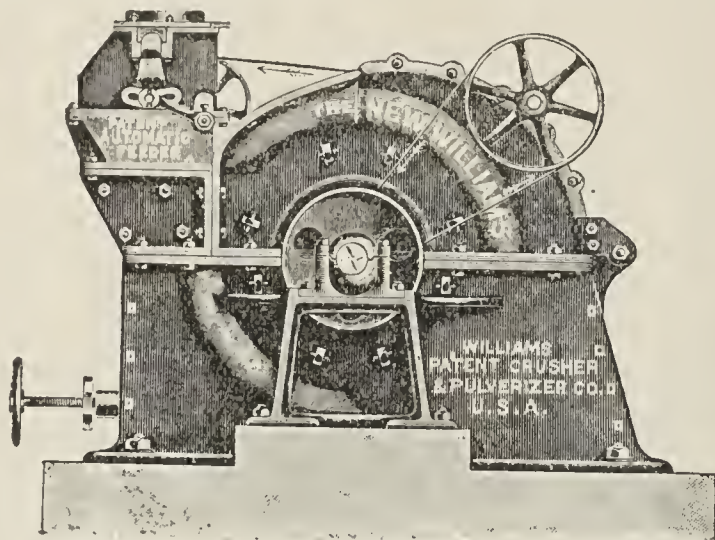
The machine consists of the same hammer principle used in the Williams old style machine, with the exception that it contains in the front end of the machine an extended corrugated grinding plate, which extends

imum, a set of old hammers can be taken out and a set of new ones put in in thirty minutes time.

The machine is a most successful grinder ahead of the tube mill, and it is the opinion of the Williams people that in the next few years this type of machine will be generally used in place of all other preliminary grinders now used in the raw end of a cement plant where the tube mill is used as a finisher.

The old or Vulcanite type of Williams machine was a very good rough grinder but did not contain this adjustable grinding plate, the cage in this machine was located directly below the hopper and extended around to the back of machine or directly back of the shaft. There was no method of controlling the adjustment on this machine, and as the hammers

however, is confined to rough work, or not finer than 1/8-inch, and, as above stated, it is generally used for grinding material to 1/2-inch and finer for the roller mills. This Vulcanite mill, No. 3 size, requires forty to forty-five horse power, will grind from twenty to twenty-five tons per hour, roller mill feed, and is a very excellent machine for preparing goods for the roller mills.



The new Williams Crusher and Pulverizer.

from the hopper in the front to the center, in the bottom of the machine, the cage or outlet joins this grinding plate directly below the shaft in the bottom of the machine, and extends around to the top or back of machine, directly above the shaft.

The grinding plate is about twenty-four inches to twenty-six inches in length and is adjusted by means of a hand wheel which is shown on the outside of this cut. The adjustment takes place while the machine is in operation, hence the machine is under perfect control at all times as to fineness, the matter of taking up adjustment is done entirely by this hand wheel and from one and one-half inches to two inches can be worn off the end of the set of hammers without opening up the machine, regulating it entirely by the hand wheel.

One set of hammers ground upwards of 39,000 tons of limestone and shale which we consider a very good record. The cost of repair parts is exceedingly low, and the easy method of renewing these hammers brings the cost of labor involved in making the change down to the min-

would wear the material would become coarser and the capacity would lessen.

With the new machine, however, it will be readily seen that by adjusting the grinding plate in towards the hammers while the machine is in operation, the point of contact between the end of the hammer and the grinding plate is the same at all times, thus increasing your capacity and maintaining a uniformity of fineness which is absolutely essential with a tube mill feed.

The Williams people do not recommend this machine from clinker, simply for the raw material, and they are of the opinion that this is by far the most economical machine that could be used by a cement maker to prepare material for the tube mill.

The Vulcanite, or old type machine, is used very extensively throughout the west for preparing limestone that has been crushed to 3-inch and under to a product 1/2-inch and finer, which is fed to the so-called roller mills, and it is a very economical machine for this work, the extent of its usefulness in a cement plant on the raw side,

SIX CARS TO TRANSPORT ENGINE.

The H. N. Strait Manufacturing Company's plant in Armourdale, Kansas City, Mo., recently finished the largest engine ever built west of the Mississippi river. The engine weighs 150 tons and is an 1,800-horsepower apparatus. It is a direct connection engine with an 800-kilowatt generator. The Great Western Portland Cement Company had the engine built to furnish power for their entire plant at Mildred, Kan. The shaft which supports the flywheel is 20 inches in diameter and weighs 30,000 pounds, which is a load for one car. Six flat cars will be used to transport the entire engine.

NEW LUMBERMAN'S PORTLAND CEMENT MILL.

Victor Beutner, a prominent engineer of Pittsburgh, Pa., with offices in the Westinghouse Bldg., under whose supervision manufacturing plants aggregating in value \$40,000,000 have been constructed, has several contracts on hand for Portland cement plants, for the equipment of which a large quantity of machinery will be required. One of the recent contracts secured is that for the construction of a 3600-bbl. plant for the Lumberman's Portland Cement Company, whose offices are in the R. A. Long Building, Kansas City, Mo. This company, which is composed of prominent lumbermen of the Middle West, owns extensive lands at Carlyle, 5 miles north of Iola on the Atchison, Topeka & Santa Fe Railroad, the lime rock and shale deposits on which are identical with those used by the Iola and Kansas Portland cement companies. It owns extensive natural gas territory and natural gas will be used for fuel. The plant will contain five 8 x 125 ft. rotary kilns operated under the dry process. The type of grinding machinery to be used will not be determined until a thorough trial has been given the mill and air separator installation in the Altoona Portland Cement Company's plant, for which Victor Beutner is also engineer. The plant of this latter company is about

finished and will be shortly placed in operation. This plant is of 2500 bbl. capacity, and its complete construction and equipment in six months is believed to be a record. Mr. Buetner has also plans for a 3600-bbl. plant for the Union Portland Cement Company, which owns large mineral deposits and gas rights at Gas, Allen County, Kan. It is expected that ground will be broken for the Lumberman's Portland Cement Company within the next 30 days, and for that of the Union Portland Cement Company early next spring.

Ira Barth, an Atchison young man, who is only 28 years old, has charge of the building of an \$800,000 cement plant at Maiden Creek, Pa., for the Atlas Portland Cement Co., which has a contract for supplying cement to the Panama canal. Mr. Barth is working under the direction of the Fuller Engineering Co., and has 400 men under him. He took the full engineering course at the best schools in the country, and is regarded as one of the coming men in his line.

The Belmond Cement & Manufacturing Co., of Belmond, Iowa, have just completed for their own use the largest building ever erected for the exclusive manufacture of cement tile. It is equipped with the latest and most improved machinery for the making of cement tile, which was bought of Cement Tile Machinery Company of Waterloo, Iowa, and they are well pleased with the equipment as it is working very satisfactorily.

The recent destructive fire at Pembroke, Canada with its attendant serious losses has been regretted throughout the Ottawa Valley. But great as was the loss it was not without its gain for it has furnished a lesson of great importance to those who will have to rebuild their houses and stores. Visitors to Pembroke since the fire have noted one building standing intact in the heart of the burned area. It is the Alexander Barr Carriage and Wagon factory and is the only building that withstood the fierce heat of the flames. It owes its wonderful preservation to the fact that it was built of Portland cement concrete blocks which has been demonstrated in scores of instances to be the best fire-resisting building material known.

"I was both surprised and delighted with the way my building stood the flames," said Mr. Barr. "The test was a particularly severe one too. The adjoining buildings were entirely swept away. They were located within eighteen inches of the walls of my building which remains standing. In addition to the severe heats of the burning buildings there was that of five cords of wood which were piled against the carriage factory wall. The cordwood was entirely consumed but the wall was unharmed. No water was used to stop the progress of the flames at this point.

The cement plant in Manchester, Mich., has been brought to Sandusky, Ohio, to be operated by the Lake Shore Cement Company, a million-dollar Ohio corporation. The con-

tract calls for an output of 3,000 barrels of cement daily, and 400 men will be employed.

AMERICAN CEMENT PLANT IN MEXICO CITY.

Consul-General Benjamin H. Ridgely writes that he is informed that a contract has just been let for a small American cement plant to be established near the City of Mexico for the manufacture of Portland cement. This will be the first plant established in the Republic for the manufacture of Portland cement, although ordinary cement has been manufactured for some time. Mexico uses a considerable amount of Portland cement, which has heretofore been imported, and if the plant in question should prove successful it is certain that there will be a considerable further demand for American cement machinery. The plant referred to is a small one and is to be installed under the contract for \$9,000 gold.

The City of Los Angeles, has appropriated \$650,000 for constructing concrete bridges and expects to increase this appropriation to \$3,500,000. These bridges are to span the Arroyos and Los Angeles rivers. The Street Railway companies have agreed to bear one third of the cost of such bridges over which it has tracks. Mr. H. E. Huntington, President of the railway system of Los Angeles, fully approves of this plan.



The above cut is a view of a new factory office building built at Tuckahoe, New York, and constructed of the Ferguson two-piece concrete block system, controlled by the American Hydraulic Stone Company, Denver, Colorado.

THE SUPERIOR PORTLAND CEMENT
COMPANY'S NEW PLANT IN
SOUTHERN OHIO.

One of the most complete and up-to-date cement plants in the country recently sprang up in the southern part of the State of Ohio. The institution referred to is The Superior Portland Cement Company of Superior, Lawrence County, whose lands were formerly known as Center Furnace, near the boundary line of Elizabeth and Decatur Townships.

The company was incorporated under the laws of Ohio in April, 1906, with a capital stock of \$525,000, all paid in. The Center Furnace property, comprising a fine tract of land of about 9,000 acres in Lawrence and Scioto Counties, was purchased of Mrs. Nannie H. Kelly. This land is rich in limestone, clay,

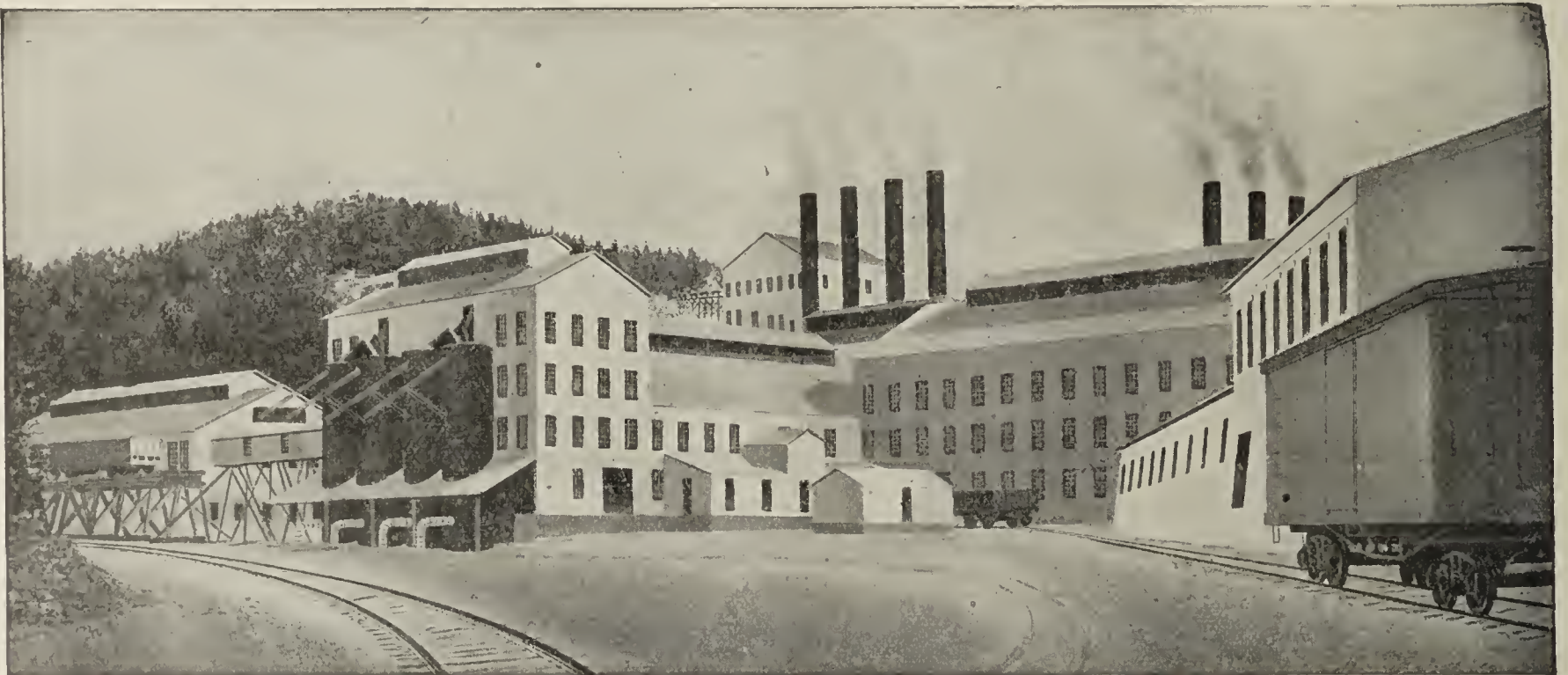
shale and coal. Soon after the purchase of this property by the Superior north of the Ohio River, and the plant, therefore, has good shipping facilities over three or four roads as well as river transportation. The buildings are substantial in every way, all being constructed of steel framework and galvanized sheeting, with the exception of the engine and boiler rooms, which have steel framework and brick for the outer walls. The floors of the entire plant are of concrete. The stock house is 100 by 350 feet, of reinforced cement construction. The sizes of the various buildings are: Raw material, 70 by 210 feet; kiln, 76 by 162 feet; clinker, 62 by 150 feet; coal, 50 by 140 feet; boiler, 45 by 120 feet; engine, 75 by 112 feet; crushing, 60 by 75 feet; machine shop, 40 by 60 feet.

The crushing plant is equipped

with cross-over dumps. The lime-veyed to four vertical coolers, and after being cooled is conveyed to the clinker mill and sent through four Mosser pot crushers; then to ten Griffin mills, and is finished by three F. L. Smidth tube mills. From these mills the material is conveyed to a large stock house, the capacity of which is 300,000 barrels. The packing house is in the center of the stock house, on either side of which is a railroad track, making it very convenient for loading.

The power house consists of six batteries, 400-horsepower each, of water tube boilers and two 700-horsepower slow-speed Corliss engines, and two 400-horsepower direct connected engines.

All the elevating machinery was furnished by the Jeffrey Manufacturing Company of Columbus, Ohio. All the machinery that has been in-



New Superior Portland Cement Mill in Southeastern Ohio.

rior people steps were taken to establish a postoffice, and also to change the name of the little hamlet from Center Furnace to Superior. On March 6, 1907, commission was given and a postoffice was established. Rural free delivery is now being made.

In July, 1906, ground was broken for what is now, in every sense of the word, a model of cement factory construction, neither pains nor money being spared to make this plant labor-saving throughout and one of the best in this progressive country.

The plant is located on a spur of the Detroit, Toledo and Ironton Railroad, about one mile from the main track, and about eighteen miles from Ironton. This road intersects all the trunk lines east and

stone is first dumped into a No. 9 Gates crusher and then goes through two No. 5 Gates crushers made by Allis-Chalmers Co. of Milwaukee, Wis. The shale is dumped into a No. 9 clay dry pan. Both the limestone and shale are conveyed 150 feet to two circular bins, the limestone bin being 20 feet in diameter and 45 feet high. The limestone is then fed into two limestone dryers and the shale into one dryer by automatic feeders. These dryers are 5 feet in diameter and 60 feet long. The material is then conveyed to three F. L. Smith'kominuters, thence to six F. L. Smidth tube mills. From the tube mills the material is conveyed to large bins over the kilns. The kilns are 125 feet long and 7 feet 6 inches in diameter. The clinker is then con-

stalled in this plant has been well tested in the cement business and has been found successful. The coal is pulverized by Fuller mills. A well-equipped machine shop for the company's own use is in close promixity to the mill.

Water for the plant is furnished by three deep-driven wells, immediately under the boiler room, and a reservoir will soon be erected on the hill, thus having an elevation of 150 feet and being close to the plant. The company will use a patented valve bag system in filling the bags, which assures the neatest and most substantial package. The capacity of the plant is 2,400 barrels per day.

The limestone deposit used by this company has been opened up in the side of the hill, and a great portion of the quarry is already

stripped. When the stripping gets too heavy the limestone is mined. The limestone when mined has a thirty-foot vein of sand rock roof and all the limestone that is mined is very clean, and free from high alumina clays or any other foreign matters which are injurious to the manufacture of cement. The shale stratum is about twenty feet thick and is opened up on the same hill as the limestone. It is loaded into tram cars by steam shovels. The company has also a good quality of No. 5 coal, which lies about thirty feet above the limestone. This gives the company all the raw materials, including coal, on their own property. The limestone, coal and shale are hauled

been an off color, but the Superior Portland Cement Company guarantee that the color of their cement is equal to any manufactured in the Lehigh Valley of Pennsylvania or elsewhere. Manager J. B. John has had much experience in the manufacture of cement from limestone and shale, the only raw materials that will enter into the manufacture of cement in this operation.

The entire plant was designed by Mr. John and the buildings were erected under his personal supervision, as well as the placing of all machinery.

The company has a well-equipped laboratory, and the chief chemist, John Blank, formerly with the Lehigh Portland Cement Company,

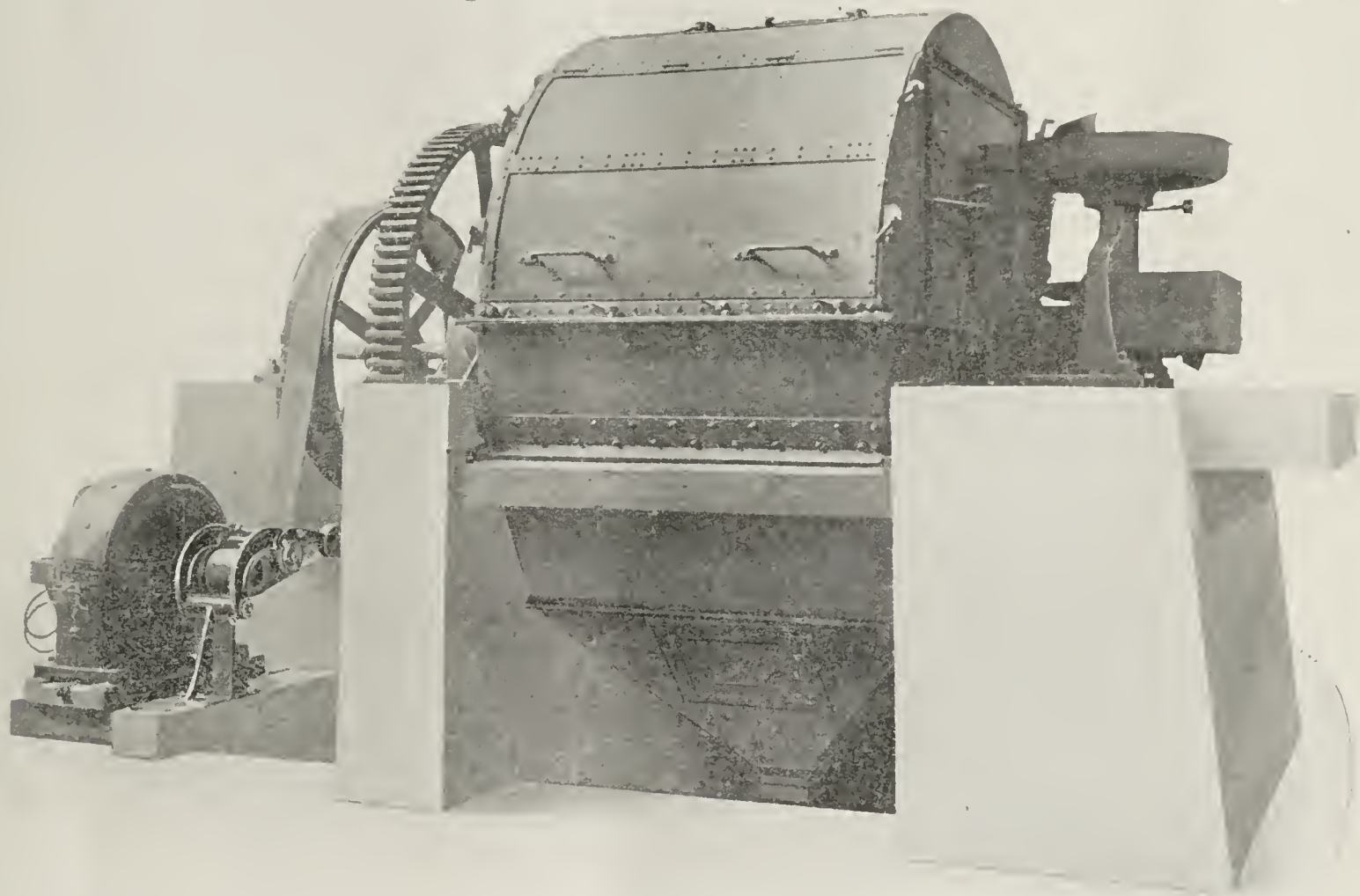
Harwood, sales manager, writes: "We made our first shipments on November 7th, 1907; but shipped very little cement, owing to the financial depression.

"We closed our mill in the early part of December, and started again in the early part of March this year, and have run the mill continuously throughout the season.

"Our shipments in August were 50,000 barrels, and in September 65,000 barrels. In September we exceeded our output.

"We have secured a number of very desirable contracts this season, and will mention the following:—

"Two contracts from the Board of Public Works of the State of Ohio;



Three of these Kominuters were installed in this plant. Manufactured by F. L. Smidth & Co., New York City.

to the crushing plant with a twelve-ton electric motor.

Frederick J. H. Merrill, geologist of New York City, has sent the company an extended report on the samples of raw materials submitted to him. The following paragraph is considered sufficient to thoroughly convince the most skeptical that the Superior Portland Cement Company has the raw material for producing one of the best grades cement on the market: "From these analyses," Mr. Merrill says, "I am able to state that the samples submitted represent material in the highest degree suited to the manufacture of an excellent grade of Portland cement."

It has always been the experience of cement manufacturers that the product from lime and shale has

has had considerable experience in the manufacture of cement from limestone and shale. John Greenall of Allentown, Pa., who is well known in the cement world, having acted in the capacity of consulting engineer, in some of the best plants in this country, was consulting engineer for this company. Eugene C. Switzer was his assistant. He was formerly with the New Castle Portland Cement Company of New Castle, Pa.

Raw material was first sent through the mill about August 20, and the first shipment of cement will be made September 16. The plant is employing only experienced cement men who have been in the business for a number of years. The plant gives employment to about three hundred men. Mr. C. F.

approximately 40,000 barrels. The cement to be used in the improvement of the Ohio & Erie and the Erie & Miami Canals.

"The State Hospital at Lima, Ohio; 11,000 barrels.

"Goodrich Rubber Company building, Akron, Ohio; 3,000 barrels.

"Tuberculosis Hospital, Mr. Vernon, Ohio; 10,000 barrels.

"Mayflower School; Bradley Building; and White Automobile Building, Cleveland, Ohio.

"Provident Savings Bank & Trust Company's Building, Cincinnati, Ohio.

"We have furnished cement to the Government for Dam 19, Ohio River.

"Considering this is our first year

on the market, we feel we have made a very good showing; and have demonstrated that Superior Cement is equal in quality to the best on the market."

This furnace is one of the oldest in the country, being built in 1832, and is yet good for many years' service. Coal mines are being operated in connection with the cement plant for the company's exclusive use.

The personnel of The Superior Portland Cement Company shows that its means are almost unlimited and that its organization is so strong, and its management so complete, that failure to succeed will be out of the question. The president, Justus Collins, was among the pioneers in developing the Pocahontas and New River coal fields in West Virginia. Mr. Collins went to West Virginia about nineteen years ago from Alabama, of which State he is a native. He has been actively and successfully engaged in coal-mining since that time. He interested with himself in the development of the cement company Messrs. M. L. Sternberg of Jackson, O.; Eugene Zimmerman of Detroit, Mich.; Col. H. A. Marting, D. C. Davis and Mrs. Nannie H. Kelly of Ironton, Ohio, and B. H. Kroger of Cincinnati. These are the principal stockholders, although there are others who own a small number of shares.

Mr. Collins, president of the Superior Portland Cement Com-

pany, is one of the moneyed men of the Mountain State, and his ability as a leader in developing new industries is known throughout several States.

Mr. L. Sternberger, the vice president, is also president of the Superior Coal Company of Jackson, Ohio. He is largely identified with business interests in Southern Ohio.

J. A. Lathram, of Charleston, is secretary and treasurer. He is a

native of West Virginia and is identified with various enterprises in that State.

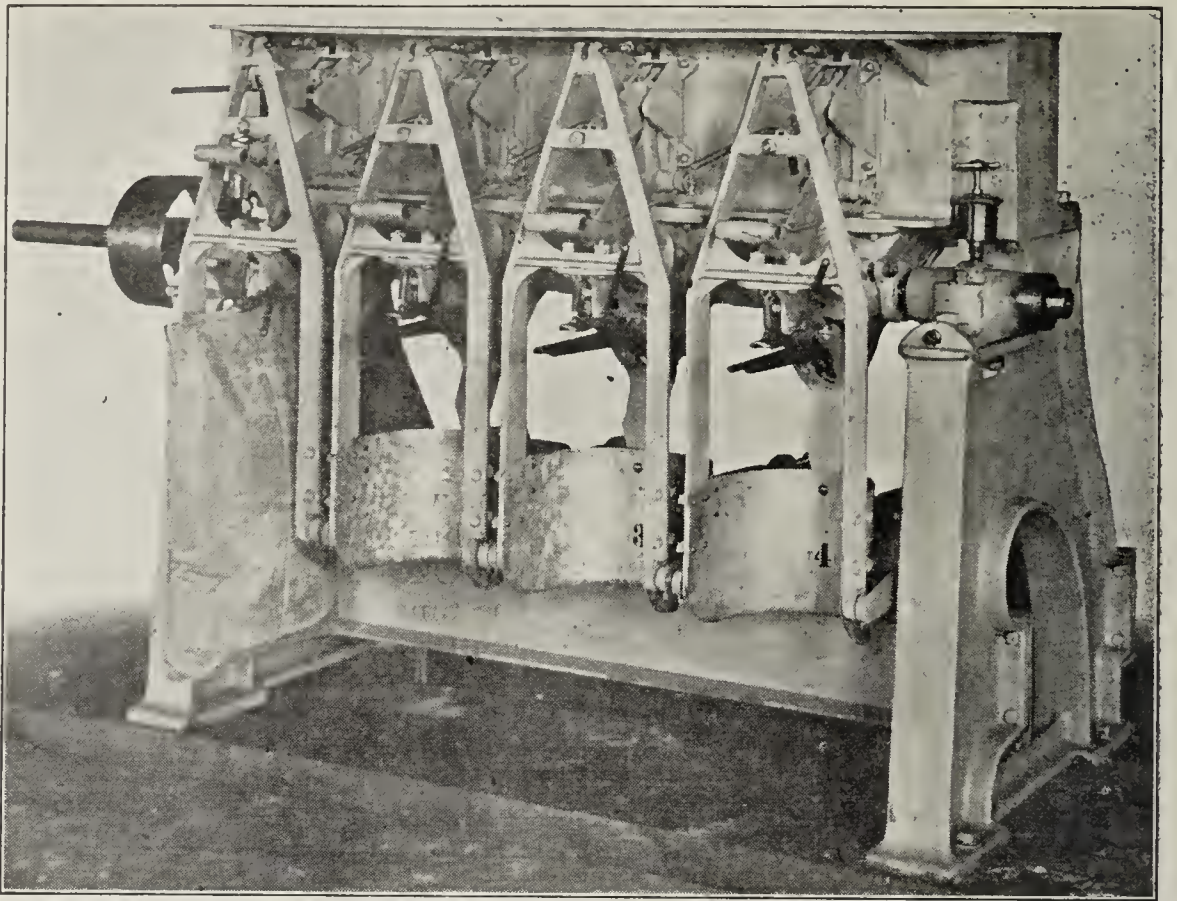
J. B. John, the energetic manager, is a practical cement man, having been in the business a number of years, and he is thoroughly conversant with every phase of it. Mr. John was connected with the Lehigh Portland Cement Company for twelve years, and has had experience in their several different plants.

C. F. Harwood, sales manager of the company, will preside over the sales office, which will be located at Charleston, W. Va. He has been connected in a similar capacity with a Pittsburgh firm. Mr. Harwood, as well as Charles Schmutz and James M. Hilands, traveling representatives, have covered in the past few months the greater part of the territory in which the company contemplate establishing a trade.

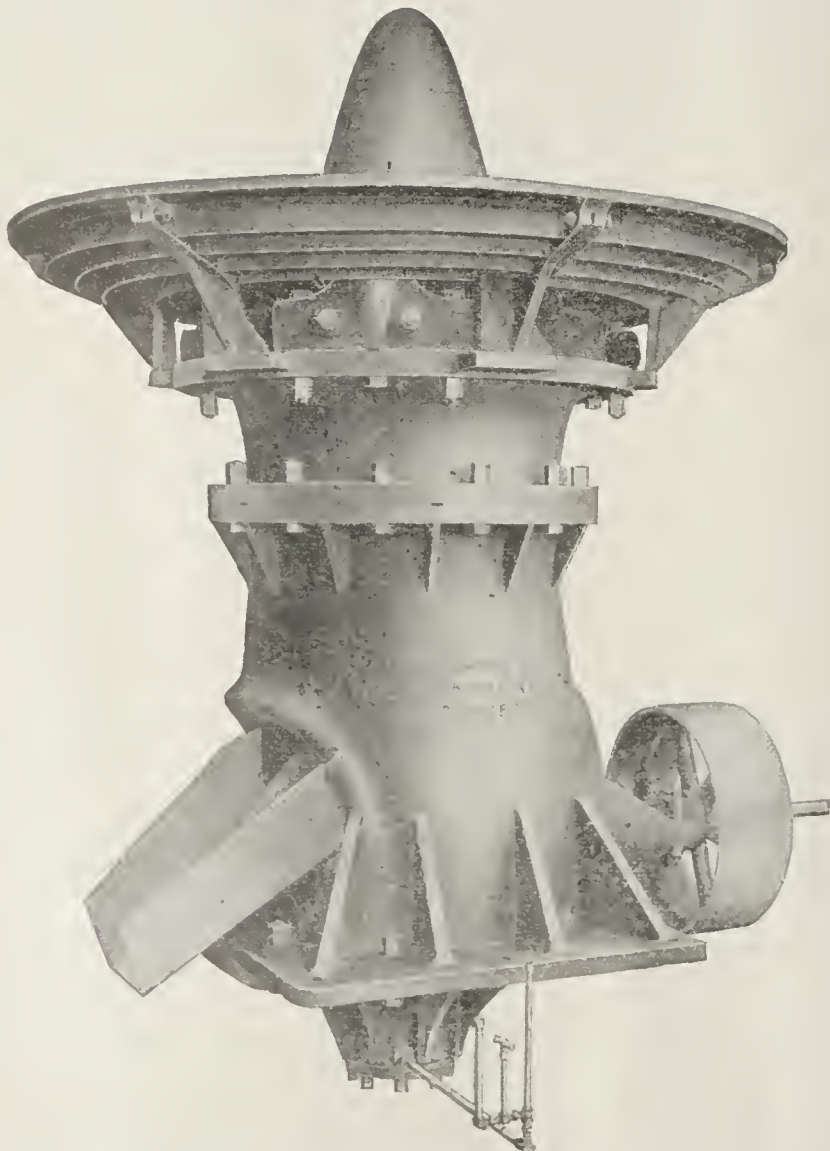
The Superior Portland Cement Company have erected twenty cottages at the plant and will put up about seventy more in the near future. These will be occupied by the employees of the company.

The Universal Portland Cement Co. has plans for enlarging its cement plant at Universal, Pa., from 4,500 daily capacity to 10,000 barrels daily capacity.

The Union Portland Cement Co., has closed contract for the construction of a \$3,000 barrel Portland Cement plant at Concreto, near Iola, Kansas. Ties and rail for a switch track have been ordered. As the track



Bates System for filling bags installed in this mill. Manufactured by Bates Valve Bag Company, Cleveland, Ohio.



Allis-Chalmers "K" Gates Breaker. Three of these were installed in this mill.

is down the delivery of materials for the plant will commence. Active construction will begin about January 1st, 1909, the Iola Electric Suburban Ry., will lay tracks from Concrete to the plant. The Union Portland Cement Co., has been organized for some time, the late panic arrested the promotion of the enterprise until money again became easy.

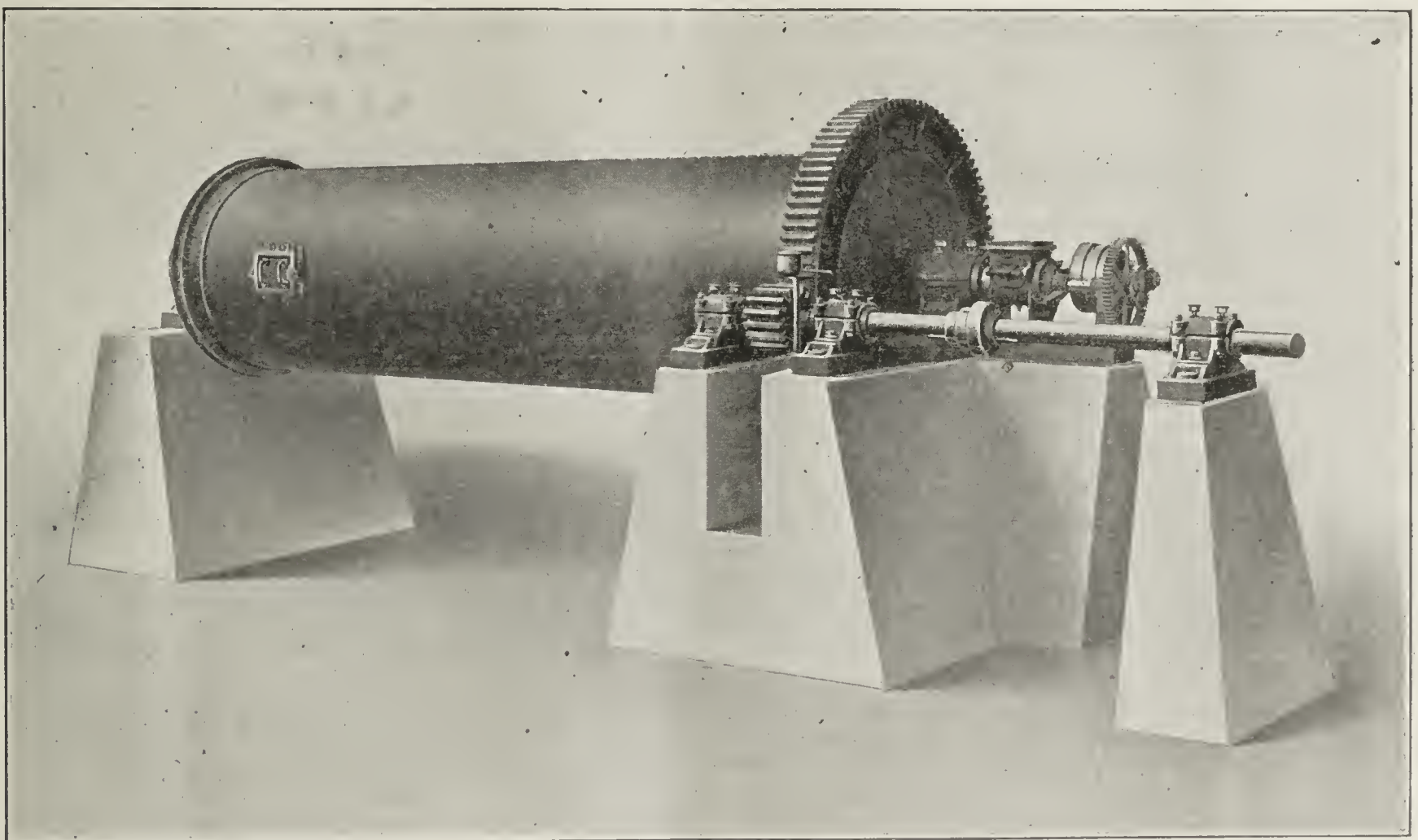
MUST USE FOREST CONSERVATIVELY TO PREVENT DEATH OF LUMBER INDUSTRY.

The U. S. Forestry Service is sending out warning notices against the wasteful use of the country's forest resources. Progressive lumbermen realize the fact that they must adopt conservative methods

yond that owned by private interest. The latter forms the great bulk of our present timber supply. We are depleting our forest in this country without making provisions for future needs. In Europe the forestry laws provide that where one tree is cut down two trees must be planted instead, in Prussia where such a law is strictly enforced the timber supply is on the increase.

A new cement manufacturing company is being organized near Grable, Wyo., with a capital stock of \$250,000, according to press reports. An expert from Oklahoma has been at work for some time and arrangements are now completed for manufacturing the cement. A contract has been signed for

additional trade classifications, making for the eighty-two pages a grand total of 33,684 headings, each one of which represents the manufacturers, etc., of some machine, tool, apparatus, specialty or material. The first edition was issued in 1891 and contained about five hundred pages, while the present numbers over 1,300 pages and contains upward of 350,000 names and addresses classified under 33,684, trade headings. The first edition required only eight pages to index its contents with 206 classifications on each page or a total of 1,648, and it was devoted solely to the building industries of the country, while the present edition covers not only that, but also the engineering, mechani-



Six Davidson Tube Mills Installed in New Superior Portland Cement Mill, F. L. Smidth & Co., manufacturers, New York City.

or live to witness the slow death of this great industry. When lumber was cheap, the waste was unusually large.

Now this waste is being conserved, lath is now being cut from slabs, the residue is sent to the pulp mills, the broken pieces, tops and limbs are likewise sent to the pulp mills.

The one serious complaint is the high tax placed on standing timber, which compels the lumbering interest to cut more rapidly than would otherwise be the case, were taxes lower. At present the bulk of our timber lands are now in private hands. The national and state forests are being conserved much be-

gas at 10 cents per 1,000 feet and there is plenty of material on hand for all purposes. The cement will find ready market in the big enterprises which are now under way in the Big Horn basin.

HENDRICKS' COMMERCIAL REGISTER

The seventeenth annual (1908) edition of Hendrick's Commercial Register of the United States is being supplied by the S. E. Hendricks Company, of 74 Lafayette street, New York. It is stated that the 16th annual 1907 edition required seventy-six pages to index its contents, while the present edition requires eighty-two pages. As each page contains 412 classifications, the six additional pages contain 2,472

cal, railroad, electrical, mining, iron, steel export and kindred industries.

The Lumberman's Portland Cement Company, with general offices in the R. A. Long Building, Kansas City, Mo., has closed a contract with Victor Beuther, Westinghouse Bldg., Pittsburg, Pa., for the erection of its cement plant on the lands of the company at Carlyle, Kan., five miles north of Iola, on the main line of the Santa Fe Railway. Work on the plant is to begin at once.

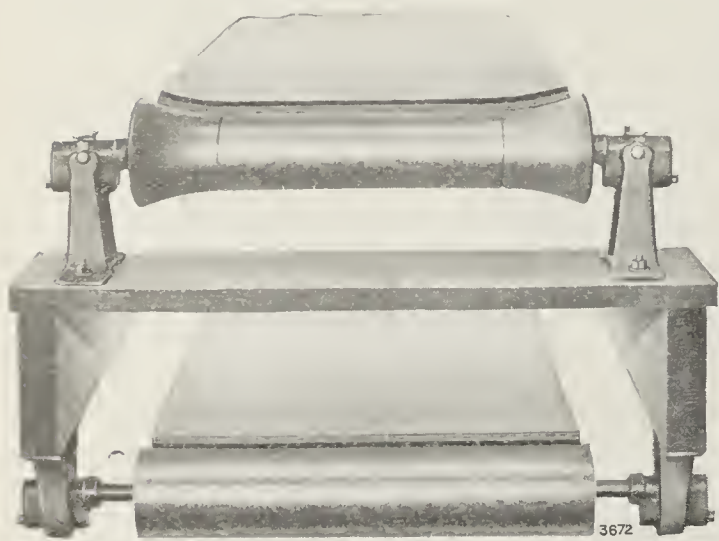
Cement shipped from the U. S. to Panama for eight months ending August 30th, 1908, was 63,357 barrels, valued at \$106,849.

PRESSED STEEL TROUGHING AND RETURN ROLLS FOR CONVEYOR OR BELTS.

Frederic V. Hetzel.

Chief Engineer, Link-Belt Company.

The question of troughing conveyor belts has always led to controversy, and about the only point that seems to have been definitely settled is that with deep troughing-rolls the belt must be made so that it will bend to the required shape, and to obtain this shape with the ordinary multiple pulley idler the belt is sometimes made up with fewer plies of fabric at the flexing part; the rubber protective cover of the belt has little or no tensile strength, and the result of reducing the fabric, especially in the cases of the wide belts designed for large carrying capacities, is to bring about



a weakening at the very point where the load is heaviest and the bending of the belt most severe. With belts in constant use this means quick wear and early renewals—all more or less costly, depending upon the location of the conveyor and other details involved in repair.

The improved pressed-steel type is shown in the illustration. The carrying-roll, rigidly secured to the through shaft which revolves in self-oiling, dust-tight bearings, consists of three parts rigidly fastened together—one straight middle section and two bell-shaped end-sections, the inner edges of which are flanged so that the center section overlaps each snugly, making a perfect joint and a roll perfectly balanced. The ends are closed, which prevents entrance of material to interfere with the rotation of the roll or throw it out of balance. A point is also made of the clear height above the supporting plank, as this effectually removes the roll from possible contact with spilled material. The carrying-run is thus over a one-piece roll on which the loaded belt bears evenly for its entire width: The result is that all troughing strain is elimin-

ated and the belt wear confined to ordinary carrying service; nor does observation show that the difference in diameters of the roll injures the under side of belt. This is no doubt due to the fact that the roll revolves at the speed of the loaded part of the belt and that rubbing is confined to its edges. The wear here is slight, and it has been found that the life of the belt is determined by the wear on the carrying part rather than on the under side.

The return rolls are of the one-piece, straight-face type, set-screwed to the through shaft which revolves in bearings identical with those on the carrying-run.

The rolls are compact, light and strong and in service under severe conditions show remarkable durability; the lightness and simplicity of construction have so reduced the initial cost that closer spacing is possible, and this, where high speeds and great capacities are desired, prevents sagging of the belt and assures smooth, easy operation, lessened h. p. consumption, and a minimum of belt wear; the rolls being fixed to the shafts which, as noted, revolve in oil, the lubricating points are reduced to two, and these are so accessible that the bearings are always in good condition.

In conclusion, the following belt conveyor principles may be laid down for the successful handling of products by this type of apparatus:

1st. There is no such thing as a universal conveyor, and belts should therefore be applied only to uses for which they are especially adapted.

2nd. The more nearly a belt conveyor approaches the flat type, the longer the belt will last, therefore, the troughing should be sufficiently shallow for the belt to assume it naturally and without strain.

3rd. Every belt, whatever its construction, should be uniformly strong throughout its width; the composition should be governed entirely by the material to be handled and the conditions under which the conveyor must run.

D. C. Newman Collins, Consulting Engineer, 29 Broadway, has just awarded the contract for the reinforced concrete Stock House for the Alsens American Cement Company, to the Turner Construction Company. The plans and specifications cover the design for the bin 25 feet high and holding all loose cement and this work is to be finished before January 1, next.

STEAM SHOVELS FOR CEMENT PLANTS.

The economy of steam shovels for digging cement rock has been amply demonstrated in nearly every large plant in the country, but in none is it more apparent than in the plant of the Burt Portland Cement Company, Bellevue, Mich. Their material consists of 16 feet of white lime rock, overlying 6 feet of blue lime rock, with a strata of blue clay about 6 inches thick between. Underlying this is from 2 to 4 feet of blue clay. It was readily seen that the steam shovel was the only machine for this work, as the action of the dipper would give the proper mixture of all the material. It was not practical to blast the material, as the blasting would blow away the clay, which is necessary in the manufacture of their cement, and it was thought that no steam shovel was strong enough to successfully handle the work. However, several years ago a 115-ton steam shovel was installed and the result has more than justified the expenditure. It has been digging ever since, and is at the present time digging their material—a 26-foot face of lime rock and clay—without blasting, as shown in the illustration, for less than 12 cents per cubic yard. The shovel is digging about 400 cubic yards per day, which is only about one-half its maximum capacity. If it was operated to its maximum capacity the present low cost would be materially reduced, as the cost to operate the shovel to its maximum capacity would not exceed \$3 per day additional. The steam shovel has proven so economical for this class of work that they are now recognized as indispensable in any well-equipped cement plant. The Bucyrus Company, South Milwaukee, Wis., make a patented steam shovel which is especially adapted to cement manufacturers use. Write for their new catalogue which is just off the press.

Plans have been prepared by the Universal Portland Cement Company, a subsidiary of the United States Steel corporation, whereby it will double the capacity of its slag plant in Pittsburg, which was erected at a cost of \$2,000,000, and which was illustrated and described in our October issue. This plant was placed in operation last winter and has since been run to its capacity of 4,500 brls. a day. The new plans provide for an additional capacity of 5,500 brls, making a total outstanding of 10,000 brls a day.

The Edison Portland Cement Co., pasted notices that the plant would close on Nov. 7th on account of the stock houses being full.

NEW PLANT OF SOUTHERN GYPSUM COMPANY.

One of the most interesting and important mineral developments of recent years in Southwest Virginia is that of the Southern Gypsum Co., which within the past three years has located an extensive deposit of gypsum, erected a fine plant, created a town and constructed a railroad four miles long in order to get its products to the market.

The moving spirit in this energetic undertaking was Dr. Frank A. Wilder, formerly State Geologist of Iowa, and now president of the company. Being himself one of the best-posted men in the country on gypsum and its manufactured products, he quickly recognized the importance of any new gypsum de-

which is quoted from the 1907 report of the State Geologist of Virginia:

Gypsum	99.39
Calcium carbonate	.21
Organic matter	.12
Silica alumina	.23
	99.95

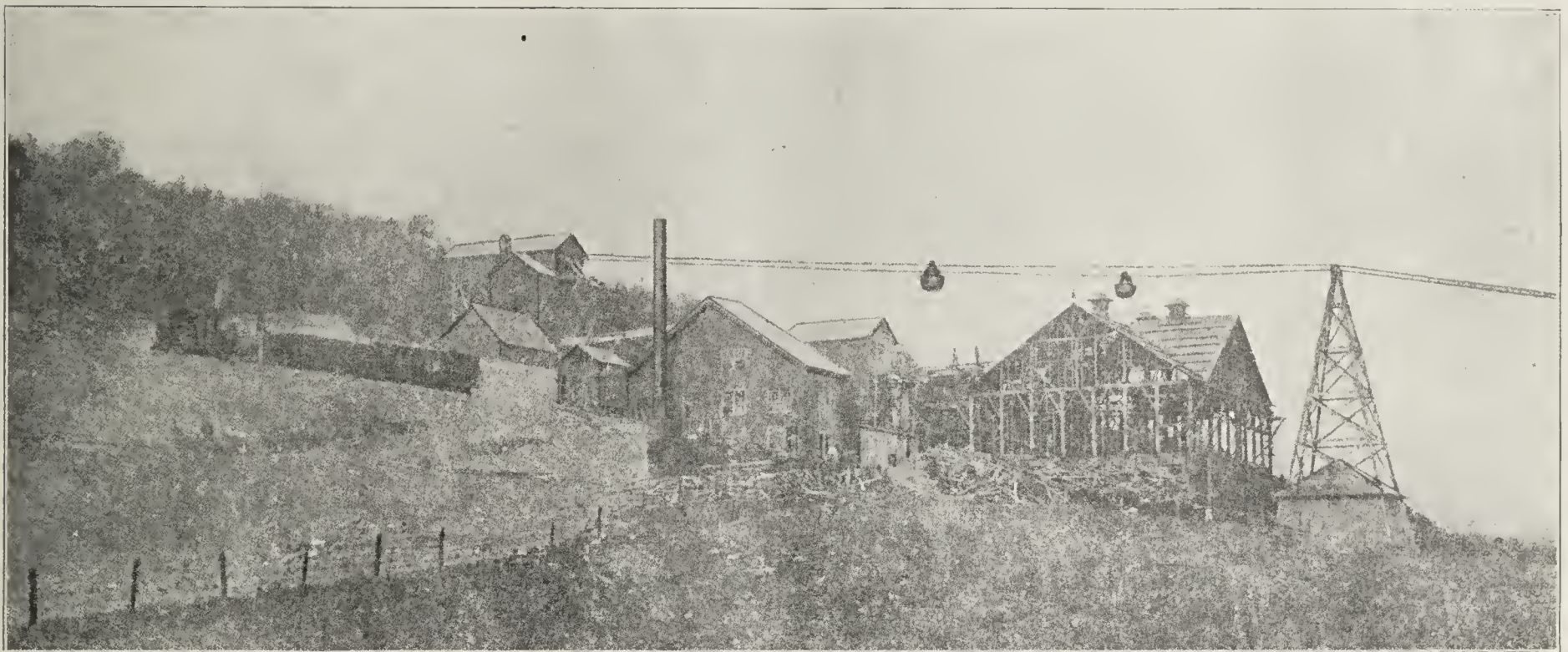
As a direct result of this core drilling the interests associated with Dr. Wilder purchased two large tracts of land and organized the Southern Gypsum Co., with a capital stock of \$500,000, of which about \$350,000 has so far been spent in development and construction work.

Active work on the development of the deposit was immediately started. The site is located four

it has been planned in units, so that at any time additions are necessary they will become part of a well-defined whole.

The mining shaft is 105 feet deep, and is divided into four compartments, two for hoisting the material, one for a ladder-way and one for air ducts and electrical wires. Two balanced cages are installed, these being operated by an electric hoist. Air is supplied to those working in the mine by a motor-driven fan, and the mine is kept dry by an electrically-driven centrifugal pump.

The mine is being opened by providing main avenues running north and south and east and west, and from these off-side openings will be made. The gypsum is blasted out



Southern Gypsum Co.'s Mill Buildings and Aerial Tramway, manufactured by Broderick & Bascom Rope Co., St. Louis, Mo. Pulverizing mills installed in this plant made by the Williams Patented Crusher & Pulverizer Co., Old Colony Building, Chicago. The condensing machinery, by the Wheeler Condenser & Engineering Co., Carteret, N. J.

posits, and when he heard of those in Southwest Virginia he determined to investigate them and satisfy himself that they did exist in value and quantity to warrant economical mining. Prospecting was started, and although told by some that the deposits did not occur in large quantities, he persisted in his efforts, and was finally rewarded by locating an important and large deposit, which, although only partly traced out, already shows from 3,000,000 to 4,000,000 tons.

In the prospecting a patented drill made in New York, was used. It took out a core three and one-quarter inches in diameter, and often as high as 96 per cent. of all of the formations passed through were brought to the surface in the form of core. Not only was this deposit found to be extensive, but its chemical purity was remarkable, as indicated in the following analysis,

and one-half miles beyond the large plant of the Mathieson Alkali Works at Saltville, Va., which is the terminus of the Saltville branch of the Norfolk & Western Railway, says Manufacturers Record of Baltimore, Md. As the site, therefore, was away from any railroad connection, the company constructed its own railroad system from its plant to Saltville. This road was splendidly constructed, and on a good grade, and cost approximately \$100,000. The company will have its own equipment, and will operate passenger as well as freight service on the line.

In planning the development of the property every advantage was taken of modern methods of both mining the raw material and turning out the various finished products. The result has been a plant containing every facility conducive to economical operation. Moreover,

with powder and broken up in the mine. It is then loaded on dump cars and carried to the surface and automatically dumped at the top of the tipple into a chute, from which it moves by gravity to crushers. From these the gypsum passes to other crushers, which reduce it to the size of a hickory nut or smaller, and it is then carried by bucket conveyors to a large storage bin, from which it passes through a central gate into buckets holding 700 pounds each. These buckets are part of an aerial tramway system furnished and installed by the Broderick & Bascom Rope Co., St. Louis, Mo. The length of the tramway is 1495 ft. having a capacity of 11 tons of Gypsum Rock per hour corresponding to 110 tons per 10 hours. The type of plant installed is what is known as the Broderick & Bascom Patent Automatic Double Rope Tramway System equipped with the

Gemmer patented self-dumping, self-righting and self-locking buckets. This is the only system equipped with this particular style of bucket, which performs the above functions without the assistance of any attendant or any additional machinery whatsoever. The buckets have a capacity of 7 cu. ft. corresponding to a load of 700 lbs. The track rope on which the load carriers travel is 1 1/8 in. in diameter while the track rope on which the empty carriers travel is 7/8 in. in diameter. The traction rope for propelling these carriers is 5/8 in. in diameter. All of the above ropes are of the Broderick & Bascom celebrated Patent Steel brand, the same being a special construction of wire rope used principally on aerial wire rope tramways. There are seven buckets on the tramway. The plant was put in commission during the latter part of 1907.

While the capacity of the plant at present is only 110 tons this can be readily increased or doubled, if necessary, by simply adding an additional number of buckets. By increasing the capacity of the tramway it will not increase the cost of transportation as the same attendants would handle the increased capacity that are now handling the 110 tons.

The buckets are attached to the moving traction rope by means of the Brown patented clip.

The operation of the tramway is as follows. One bucket is located at the loading chute while the balance of the buckets are in operation on the line. As a carrier enters the loading station it is detached automatically from the moving traction rope and the clip passing on picks up the loaded bucket. This bucket now travels out over the line to the discharging station where a stripping device engages the tripping handles of the bucket permitting same to discharge its contents into a bin automatically; the bucket now rights and locks itself and passes on to the loading station where the operation is again repeated. With this arrangement you will note that it is not necessary to stop the line to load the buckets nor is it necessary to stop the tramway while the buckets discharge their contents. One attendant handles the entire output. In view of the fact that the clips are permanently attached to the traction rope it insures safe connection for the buckets at all times which is not the case on other systems where friction grips are employed.

The mill building are constructed on the general plan of the Western

quartz mills, and the material passes through them on a gravity plan, thus eliminating most of the elevators usually required in gypsum plants. The plant consists of three parts—pulverizing, calcining and mixing.

The buckets of the tramway system upon reaching the mill dump the material automatically into bins, from which it passes to the pulverizing mills made by the Williams Patent Crusher & Pulverizer Co., St. Louis, Mo., and Chicago, Ill. These reduce the gypsum so that 80 per cent. of it will pass through 100-mesh screens. The pulverized gypsum is then carried by screw conveyors to large bins in the calcining department, and from these directly to the calcining kettles, which hold 10 tons each, and are of the type common in gypsum mills. The calcining kettles empty by gravity into hot pits, from which the material is carried by spiral and bucket conveyors to the mixing plant. The building containing the mixing plant is three stories in height and 56x78 feet. The calcined material is here reground until practically all of it will pass through the 100-mesh screens. In this building is also installed the machinery for shredding wood, picking hair and mixing these and the retarder thoroughly with the calcined gypsum, which forms the basis for all hardwall plaster.

The plant has been designed for a total output of 500 tons daily, distributed as follows: 200 tons wall plaster and stucco, 100 tons land plaster and 200 tons crushed gypsum for cement plants.

Power for all purposes of the plant is supplied from the company's own power house, located about one-half a mile from the plant proper. The structure is of reinforced concrete throughout, and contains a 600-horse-power steam turbine, direct connected to a generator and condensing machinery manufactured by Wheeler Condenser & Engineering Company, Carteret, N. J.

The company has also laid out the town of North Holston and erected a number of attractively designed houses for its employes, in whose welfare and comfort it takes a deep interest. It also donated land and is building a modern school house at its own expense for the education of the children of its employes, and upon its completion it will be under the supervision of the county school authorities.

The accompanying illustration gives a good view of the mill

buildings, showing the tramway system and three units — the pulverizing building, highest up on the side of the mountain, the calcining building just below it and the mixing building in course of construction. In this view the company's railroad can also be seen, running through the center of the plant.

This plant is of more than ordinary importance because, as far as the company knows, this section contains the only gypsum deposit in the Southeast of the Mississippi river. The company is in a position, therefore, to cater to a wide and constantly increasing consuming area, and its location near the heart of Southern activities will enable it to make quick shipments to all leading points.

For its cement wall plaster the company has chosen the trade name of "Boone Brand," this being suggested by its geographic association with the boyhood home of Daniel Boone. The land plaster will be known as "Pierson Farm," this being taken from the famous land plaster beds now accessible and for which in the old days people would drive 60 miles to obtain.

The officers of the company are Dr. Frank A. Wilder, president; A. W. Ristine, vice-president; C. H. Edwing, secretary and treasurer; and C. H. Wallinger, superintendent. All of these men have been intimately associated with the gypsum industry in Iowa, and this knowledge, coupled with the value of the deposits here, insures not only high-grade products to the consumer, but, also a bright future and profitable business to the company.

L'argus de la Presse, destroyed by a terrible fire six months ago or more, is completely re-organized and re-established at Faubourg-Montmartre, L'Argus des Revues, special publication, has never interrupted to be published; with regard to the Argus de l'Officiel and the Archives de la Presse, both are in operation as in the past.

A cement manufacturing company is being organized at Grable, Wyoming, by Oklahoma promoters, according to an item in the Omaha Bee of October 20th.

J. M. Edwards who is promoting a cement plant to be located on the Snake River in the upper Columbia river country passed through Asotin-asotin Co., Washington, with a lot of laborers to rush the work on the plant.

THE CALDWELL PATENT CONVEYOR COUPLING.

A new coupling for spiral or screw conveyors has been recently patented by Mr. F. C. Caldwell of the H. W. Caldwell & Son Company, 17th St., and Western Ave., Chicago, Ill. The coupling that has been standard for screw conveyors, and which was the invention of Mr. H. W. Caldwell, in the well-known four bolt coupling, which consists of a solid coupling shaft in which are drilled bolt holes, corresponding bolt holes being drilled in the conveyor pipe and machine bolts forming the connection between the coupling shaft and the hollow shaft of the conveyor pipe.

In manufacturing the four bolt coupling it is endeavored, so far as possible, to make the bolts a tight fit in the holes to prevent loss of motion, but, in the course of time the bolts will become loose and gradually cut off, or the bolt holes in the pipe will wear out. Where the service of the conveyor is severe this is apt to occasion more or less frequent repair and loss of time due to shutting down. The mechanical criticism of the four bolt coupling is that the bearing surface and the surface to resist wear that is presented by the circumference of the machine bolt which presses against the wall of the pipe is comparatively small. The effectiveness of such a coupling might be compared with a set screw for fastening a pulley.

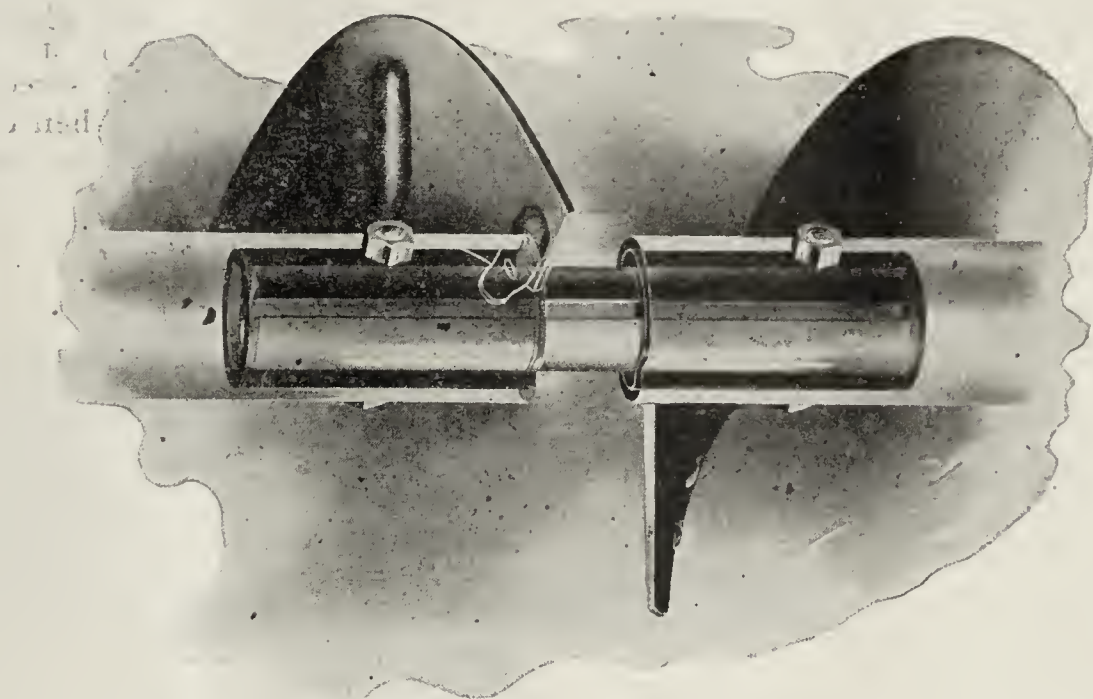
It will be readily recognized by practical men that anything that will improve this feature of the spiral conveyor will be a distinct advantage and the Caldwell Coupling shown by the illustration is resigned for that purpose.

By referring to the cut above, it will be seen that the conveyor pipe

has an internal bushing and that, as a part of this bushing, is formed a feather key which projects into a keyseat cut in the coupling shaft. The effect of this is to provide a bearing and wearing surface equal to the face of the key and when this is to provide a bearing and wearing surface equal to the face of the key and when this is calculated as compared with the coupling bolt surface, the increased surface of the key is so great that its strength as a power transmitting appliance and

be used where a chilled cast-iron bushing is used as a sleeve on the coupling shaft, this sleeve running in the hanger bearing proper. For ordinary purposes the shaft would be left round at the hanger space and run in a babbitted bearing and in such case it would be practical to entirely discard the bolts shown, thus furnishing a coupling without any coupling bolts whatever.

The Caldwell Company offers this improvement to the trade as the latest of the many improvements



its durability is very much greater, in fact it is doubtful whether in any use to which the conveyor is to be put this key will wear off or be broken off. The internal bushing is prevented from turning inside the conveyor shaft by having on its outer surface a groove into which the pipe is forced while hot. The bolts shown are only intended for the purpose of preventing the coupling shaft from moving endwise and these bolts are not intended for transmitting power.

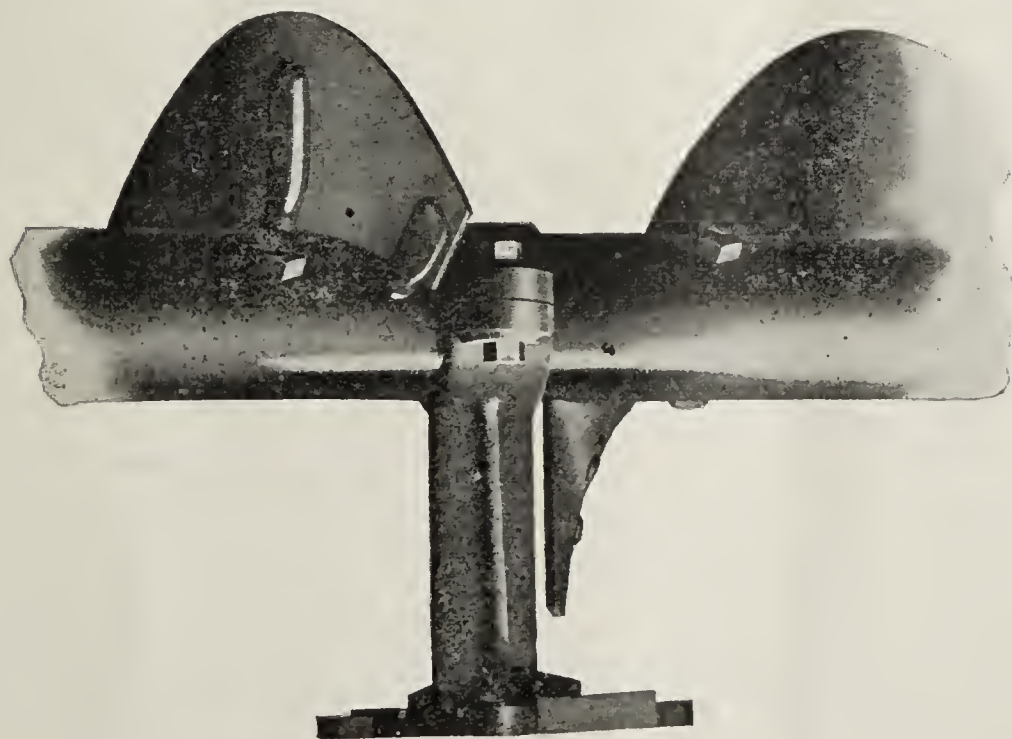
The coupling shown with the keyseat running the full length of the shaft is designed especially to

in spiral conveyor that they have brought before the users of this specialty. Having been in this line of manufacturing since 1875, they are, of course, fully conversant with the requirements of this special type of conveyor and in fact claim that the commercial use of spiral conveyor is entirely due to the attention they have given to the industry from the time they first undertook the manufacture of this specialty.

NEW CANADIAN CEMENT PLANT AT EXSHAW.

Forty-eight miles from Calgary, Canada, and surrounded by the small industrial town of Exshaw, named after one of the company's active directors, are situated the great new Portland cement mills of the Western Canada Cement & Coal Company. The plant, comprising fifteen buildings in all, of fireproof construction, has an approximate floor space of 3 3/4 acres and a daily capacity in finished product of 2,000 barrels.

The cement company owns over 1,200 acres of limestone quarries from which the present plant may be supplied for a period of 500 years at its maximum output without exhausting the supply. The limestone is of high grade quality, averaging over 98 per cent of carbonate of



lime, and is quarried from solid rock by means of electric drills.

The quarry cars are operated wholly by means of gravity, no power being used in handling, the loaded car being started for the tipple on a slight grade. On being dumped from the cars, the limestone goes down a steel chute into a No. 7 1/2 and a No. 4 type "K" Gates crusher, built by Allis-Chalmers Company, Milwaukee, and supplied through Allis - Chalmers - Bullock, Ltd., Montreal. On the way to the dryers the belt conveyor passes over the rock storage bins, which are capable of holding 10,000 tons of crushed rock, a two weeks' supply for the mill. The belt conveyor, on its return trip passes underneath these bins and, in the event of the rock supply from the outside workings being cut off, bin gates are opened directly onto the conveyors which elevate the material and carry it to the dryer hoppers.

Having let the first system of belt conveyors, the rock is received by an automatic feeder into the dryers. These dryers are specially designed cylinders 80 feet in length set on a slight angle of one inch to a foot. At one end is a furnace and a fan at the other. The fan draws the full heating power of the coal through the constantly rotating cylinders, thereby eliminating all moisture from the finely crushed rock.

Coming from the dryers the rock is carried on a steel chute on a separate set of conveyors, elevated and transferred to a set of grinding mills for fine crushing. From these grinders the now finely powdered substance is carried by a conveyor belt to the storage tank, whence it is drawn through the bin gates and carried to the mixing bins. At this stage of the process the chemist starts his analysis, on samples taken every half hour from each bin. A constant check is thus kept on the quality of the limestone that goes to the mixing troughs.

The next step in the process is the mixing of the limestone with the shale. The Exshaw works are fortunate in having two separate and distinct qualities of clay to draw upon. Analyses are made of the clay as of the limestone and the results from the basis for calculating the percentages of each to be used. The clay passes through much the same process as the limestone. It is crushed several times. Two drying processes are given it, in order to eliminate even the faintest trace of moisture when it mixes with the lime. After the mixing of the two clays, the product is then ready for the final

mingling with the limestone. It is next carried by a conveyor belt to four mixing hoppers, two for each ingredient, so that while one set is being mixed, the other is placed in readiness. The completed mixture consisting of approximately 20 per cent clay to 80 per cent rock, is then carried by the conveyor to the battery of tube mills, sixteen in all, 5x22 feet, built by Allis-Chalmers Company, and driven by means of electric motors.

The cement kilns are 80 feet long by 7 feet in diameter and bottle shaped after the design of the company's engineers. Powdered coal is used for fuel. The clinker is ground fine in another set of grinding mills, after which the finished product is sent to the finished bins, which have a capacity of 140,000 barrels. Cana-

consisting of some 40 arcs and 400 incandescents, is carried by the exciters, also of Allis-Chalmers build, in addition to their work of furnishing current exciting the turbo alternators.

The Western Canada plant represents an investment of approximately a million and a half dollars. Sir Sandford Fleming, K. C. M. G., is president, and Mr. P. D. MacKinnon is general manager.

Manual of Reinforced Concrete and Concrete Block Construction. By Chas. F. Marsh, M. C. E., etc., and Wm. Dunn, F. R. I. B. A. Illustrated, 113 diagrams and figures; 290 pages, 4 3-8x6 1-2 inches. Price \$2.50. D. Van Nostrand Company, Publishers, 23 Murray street, N. Y.



Allis-Chalmers Tube Mills, installed in this plant.

dian Pacific Railway spur tracks are placed conveniently so that twenty cars may be loaded at once from the loading platform.

The power house equipment for this plant is typical of the best modern practice in every respect. Three Allis-Chalmers 1000 K. W. steam turbine generator units have been installed, each to generate current of 60 cycles, 3 phase, at 600 volts. These turbines are driven by steam, using coal brought from the company's own mines, comprising a property of 300 acres of coal lands which contain high percentage of volatile combustible matter.

The current generated from the turbo units are devoted entirely to power purposes; the lighting load,

This treatise contains in course form the necessary information required to properly design and construct reinforced concrete structures, describing the methods employed in the solution of problems that daily arise in actual practice.

The book is divided into seven chapters as follows: 1 Materials, 2 Construction, 3 Waterproofing and Fire Resistance, 4 Loads and Bending Moments, 5 Calculations, 6 Hollow Concrete Blocks, 7 Tables, Diagrams and General Information.

It is expected that the plant of the Atlantic Portland Cement Company, which is being built between Stockertown and Nazareth, Pa., will be completed January 1.

THE HAWAIIAN ISLANDS PORTLAND CEMENT AND LIME CO.

The W. F. Cowhan syndicate is to erect a Portland Cement Plant at Waianae Island of Oahu, about 36 miles from Honolulu. The plant is to have a capacity of 1,000 barrels per day, there being little clay in the Hawaiian Group of Islands,

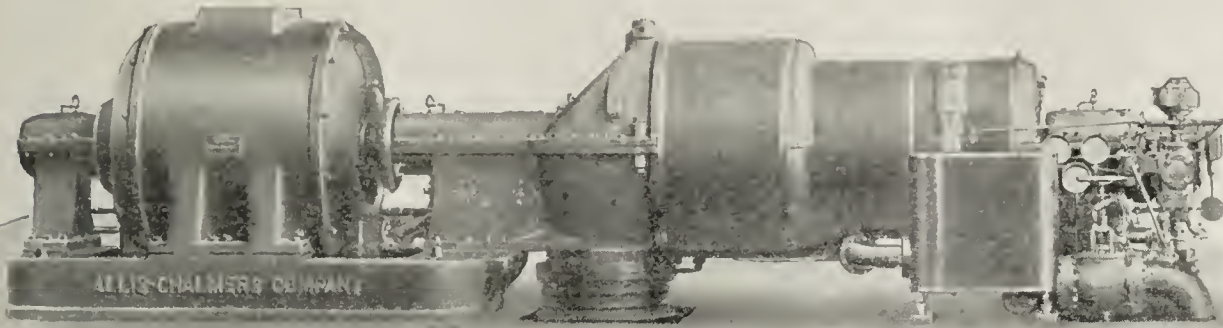
Kan., for furnishing the Shoshone irrigation project, Wyoming.

WATERPROOFING UNDER DIFFICULT CONDITIONS.

The land adjacent to the water front of New York City in the lower part of town is practically all made land, the filling material being of a

The successful waterproofing was done by applying a coat of cement mortar mixed with Wunner's bitumen-emulsion to the floor and walls on the interior of the building. The former water-proofing was left in place and the brickwork carefully cleaned. The waterproofing mortar was then applied in two coats, giving a final thickness on the walls of $\frac{3}{4}$ in. and on the floor of $1\frac{1}{2}$ in. In places where the water pressure was sufficient to carry away the materials, they were put under pressure by weights until the mortar had set. The proportions of the mortar were one sack of cement, three sacks of sand, sufficient water to make a medium thick mortar and 2 qt., or 5 lb., of Wunner's bitumen-emulsion. While placing the waterproofing the cellar was kept dry by constant pumping, a sump, consisting merely of a hole 1 ft. deep, being dug at the cellar door.

More recently two difficult waterproofing jobs have been done with the same material. Both are in the Hudson Tunnels in New York City. The first was a joint about 6 in. wide between the sloped roof over the stairway and the roof over the platform of the Ninth St. station. The water pressure here was considerable. The roof over the platform is in a valley between the cast iron and concrete arches of the two tunnels, the tops of which are considerably higher than the platform roof, and absolutely prevent the escape of the water seeping into the valley between them.



One of three Allis-Chalmers 1,000 K. W. Steam Turbines installed in the plant of the Western Canada Cement & Coal Co.

lava rock will be used as substitute for clay. The company will be capitalized at \$1,000,000, \$500,000 at 8 per cent. preferred stock, \$500,000 common. W. F. Cowhan of Jackson, Mich., is at the head of this enterprise.

miscellaneous character containing broken rock, discarded building material, sand and pebbles. This mixture offers little resistance to the seepage of ground water and is completely saturated in places even before high water level is reached. The cellars on Front St., from 300 to 400 ft. from the bulkhead line, are generally flooded and practically useless. The one at 38 Front St., measuring about 25 x 35 ft., is about 6 ft. deep, below street level, and held about 2 ft. of water most of the time, this depth being reached within 12 hours after the cellar was pumped dry. In two of the corners quite decided waterproof it proved unsuccessful, streams came in. A first attempt to waterproof it proved unsuccessful, and a second contractor lost heart after barely beginning the job. The work, however, was successfully done last winter, and after seven months the floors and walls are perfectly dry, not even showing moisture on the surface.

The officials of the Victor Portland Cement Company, who took a number of men from Los Angeles to their rock deposits in San Bernardino county on Wednesday, returned yesterday morning. The guests of the company were highly pleased with the quarries. Those who made the trip were Harrison Albright, Lycurgus Lindsay, F. E. Engstrum, G. H. Hamilton, F. H. Banks, J. G. Meachen, R. J. Aery, H. Brisacker, A. Fixen, C. N. Booth, Messrs. Forbes and Bennett and others.

GET BIG CONTRACT.

A contract has been awarded to the Iola Portland Cement Company, Iola,

IMPORTS OF CEMENT INTO THE UNITED STATES.

WHERE FROM	SEPTEMBER				NINE MONTHS ENDING SEPTEMBER			
	1907		1908		1907		1908	
	Quantity in lbs.	Value in Dollars.	Quantity in lbs.	Value in Dollars.	Quantity in lbs.	Value in Dollars.	Quantity in lbs.	Value in Dollars.
United Kingdom . .	88,000	\$474	11,318,400	\$35,801	145,342,016	\$501,272	62,405,210	\$236,775
Belgium	198,400	536	10,634,482	34,362	191,759,985	568,156	106,894,483	343,385
France	1,080,529	4,745	4,935,981	21,782	10,586,429	39,849	11,128,086	44,110
Germany	33,812,082	117,836	9,808,410	37,814	244,629,972	779,279	80,401,996	308,570
All Other Europe . .					980,263	2,129	1,379,048	5,098
British North Am. .	29,900	189	2,546,620	13,603	314,550	1,968	3,573,470	13,777
Other Countries . .	793,650	4,244			5,631,874	30,128	345,019	1,912
TOTAL	36,002,567	128,024	39,243,893	143,362	599,195,089	1,922,781	275,127,262	958,537
Domestic Exports of Cement, bbls. . . .	80,976	126,055	68,447	98,585	676,792	1,110,077	658,740	999,530

There were 11,696,612 lbs. of imported Roman and Portland Cement, etc., in the United States bonded warehouses in September, 1907, valued at \$32,232, against 13,322,369 lbs. in September, 1908, valued at \$46,327.

For nine months ending in September, 1907, there were 90,091 tons of asphaltum imported in the United States, valued at \$376,769, against 102,316 tons imported in nine months ending September, 1908, valued at \$435,958.



Office building in New York, basement of which was successfully waterproofed by Wunner's Bitumen Emulsion after several other makes failed.

Attempts had been made to close the joint, but without success. Finally the space was cleaned out for a depth of about 6 in. and filled with layers of cement mortar mixed with the Wunner bitumen-emulsion, the courses being held in place by braces against the stair treads wherever the pressure threatened to carry away the material before it had set. The work had been completed about three weeks when examined on Oct. 10 and was apparently tight.

The other work referred to was on the roof over the platform of the Christopher St. station, which is built in a valley similar to the roof of the Ninth St. station. The leak here was more or less continuous for the entire length of the platform, 350 ft., the water coming in between the concrete arched roof and the top flange of the steel girder on which the roof is carried. The roof had been previously waterproofed from the inside. The leaks for the greater part of the length of the platform have now been closed, work at one end of the platform being still in progress. The old waterproofing and concrete were torn out for 3 to 4 in. above the top of the steel flange of the girder and for a depth of 2 to 3 in. The concrete was then cleaned, while the paint and priming coat were scraped from the flange to expose the steel. The latter was dried with an air blast,

quickly coated with Wunner's bitumen-emulsion, dusted with dry cement and the hole filled with cement mortar mixed with the emulsion. All these steps had to be taken as quickly as possible so as to secure a bond between the mixture and the steel. The flow of water and the pressure were such that each layer of waterproofing had to be held in place under pressure as soon as placed, and held so till the material had set. This was accomplished by covering the waterproofing with strawboard and running a brace across to the girder on the other side of the platform.

The waterproofing of the cellar on Front St. was done by the U. S. Waterproofing Co., and the work in the stations of the Hudson Tunnels by the forces of the tunnel company under the supervision of the U. S. Waterproofing Co.

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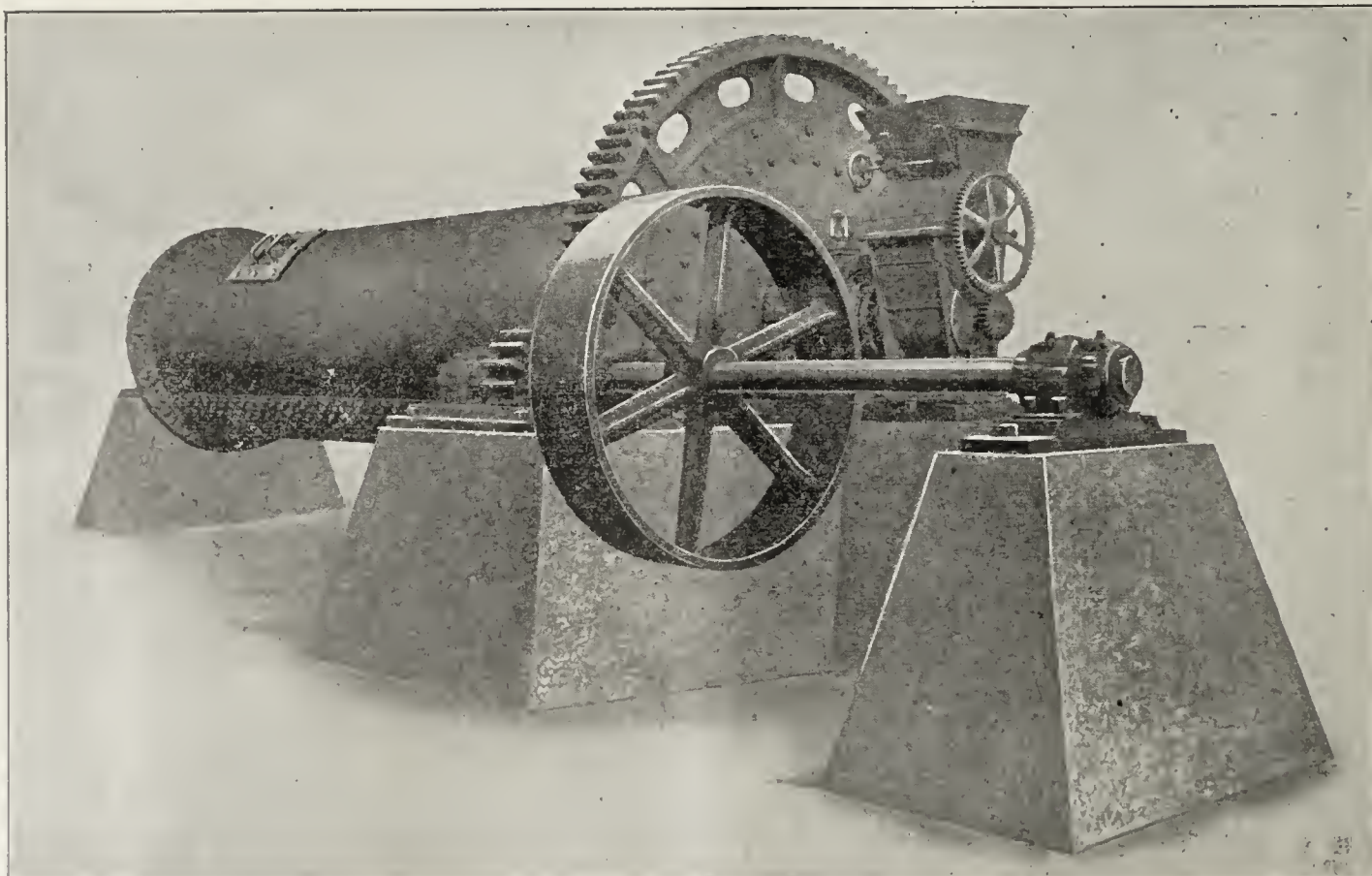
Wilhelm Ernst & Sohn, Publishers. Berlin, W. 66, Wilhelm Strasse. 90 Germany.

As usual the Beton Kalendar con-

tains about all the modern data relating to reinforced concrete construction, showing the advance made in this art. It contains many useful tables, diagrams and formulas which will assist engineers and architects in designing reinforced concrete structures on safe and practical lines, conforming to the exacting building laws of European countries; cross-sections and profiles of various kinds of reinforcing members and reduced working drawings, specifications for bridges, arches, sewer and other pipes, beams, girders, floor spans, chimney stocks, carried out under first class engineers all over the world. Concrete mixing machines and appliances for the economic handling of concrete in large and small structures.

The theory of reinforced concrete beams and girders by F. Von Emperger. The regulation and control exercised by the various European governments over reinforced concrete construction. Specifications prescribed by the German Beton association for mixing concrete and carrying out construction work, including the testing of concrete materials.

Vol. 2 deals with active construction work, plain and reinforced, and forms used. The book contains much other useful and general information relating to patent, specific gravity of materials, waterproofing compounds, apparatus used in conducting tests.



The above illustration is a view of the Krupp Tube Mills which were installed in the new plant of the Maryland Portland Cement Company at Security, Maryland, which was described in our last issue. Krupp Ball Mills were also installed in this plant. The Crescent Portland Cement Company's new plant at Wampum, Pa., was also equipped with Krupp Tube Mills.

Condensing Apparatus For Cement Mills

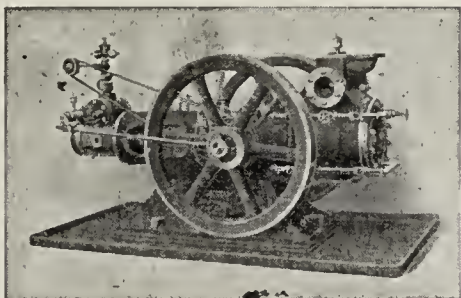
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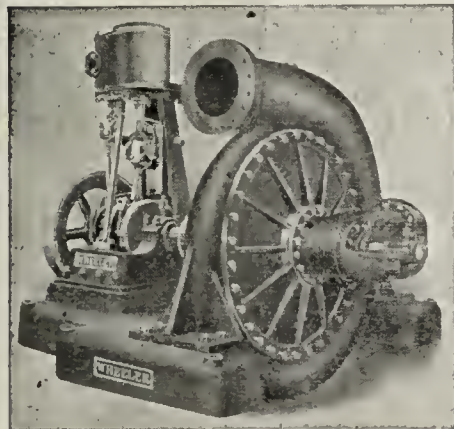
The Wheeler-Volz Condenser not only condenses all the steam and supplies a vacuum for the engine, but also

preheats the boiler feed water, so that the boilers are protected from temperature strains and the coal economy is increased. Each 10% increase in feed temperature represents 1% saving in coal. Where cold circulating water is not available, the Wheeler - Barnard Water Cooling Tower makes it possible to obtain good vacuum.



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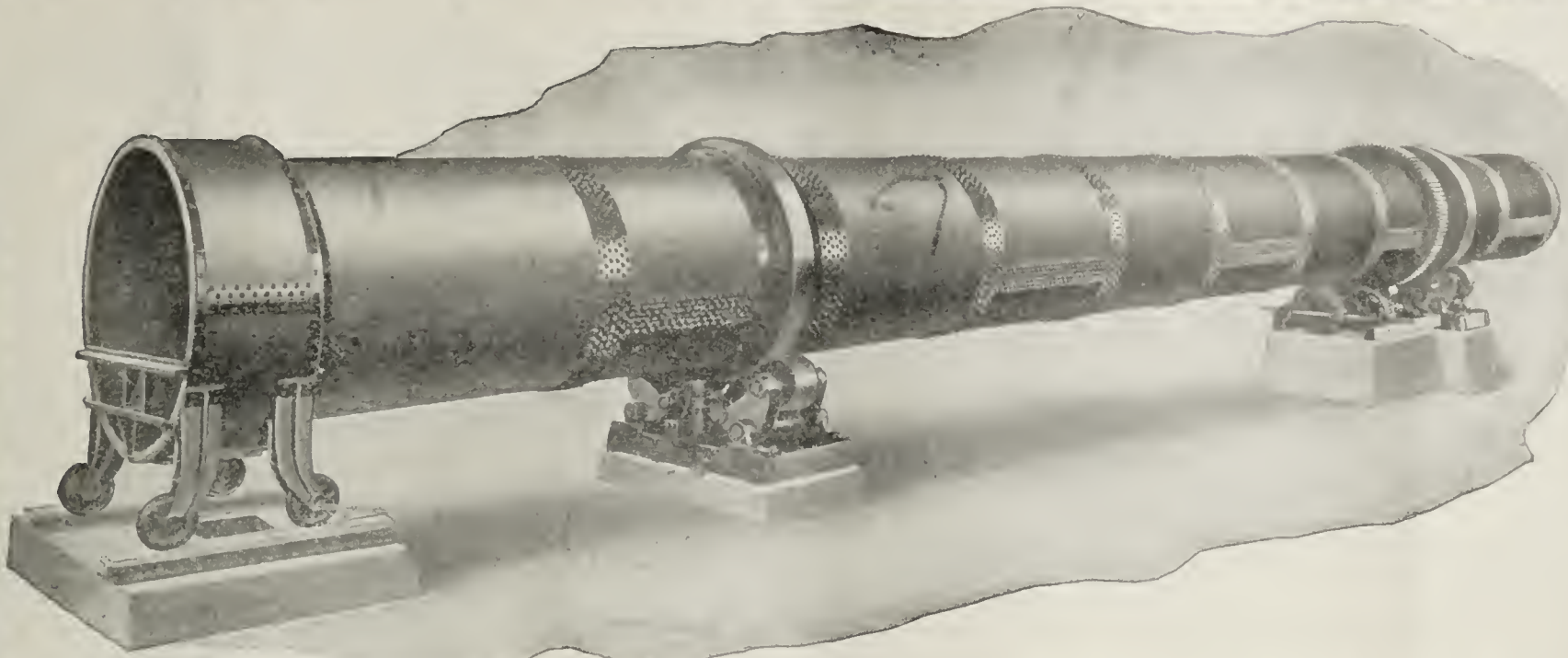
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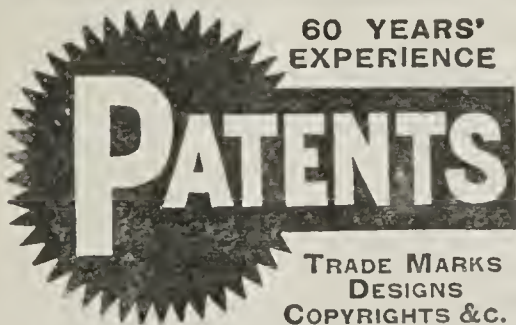
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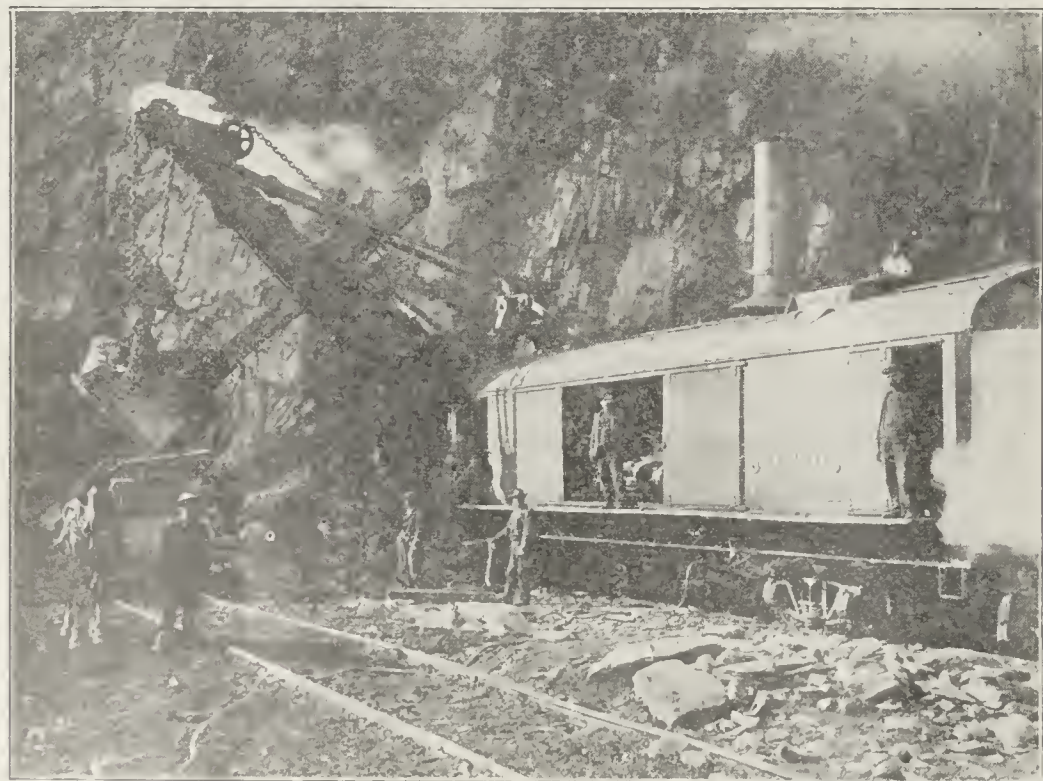
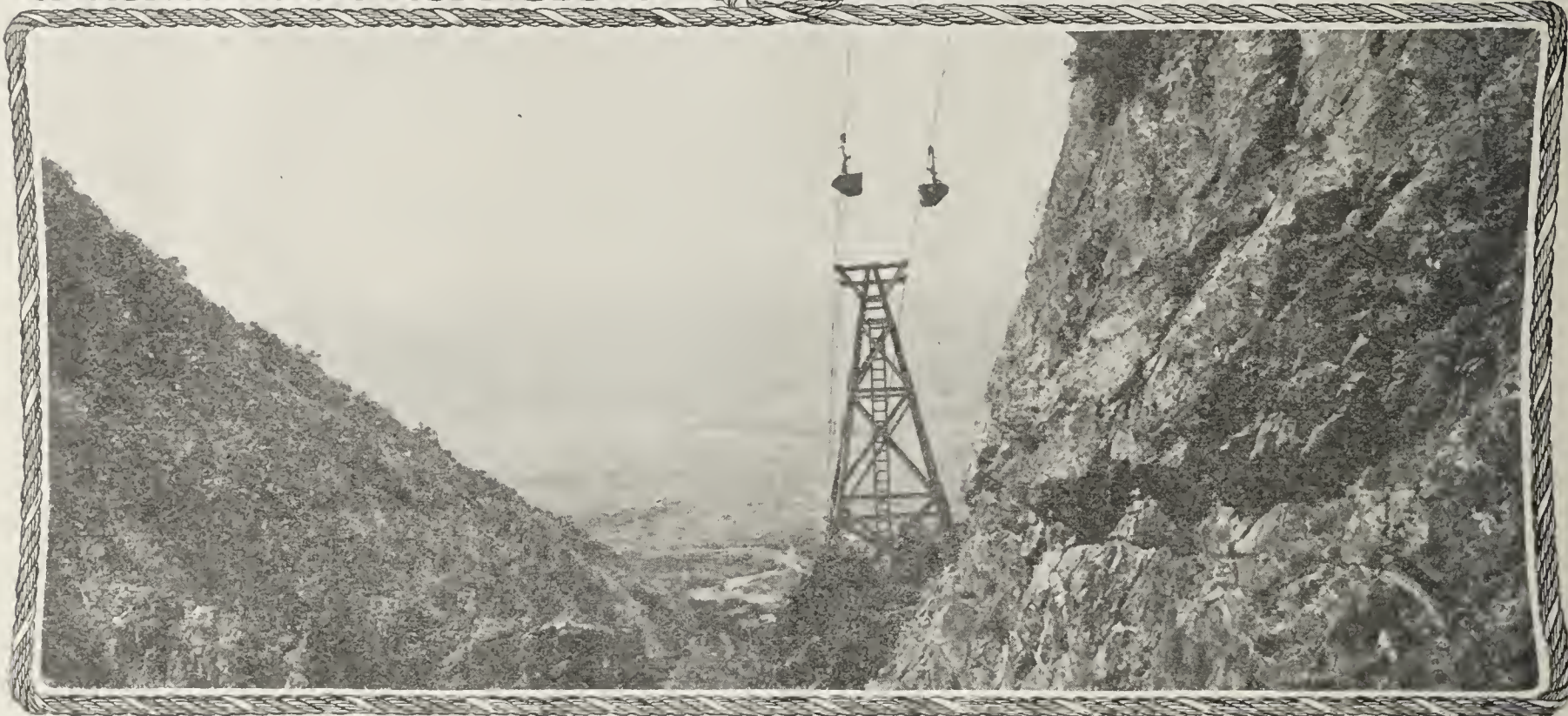
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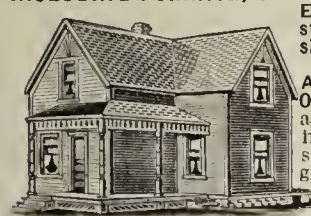
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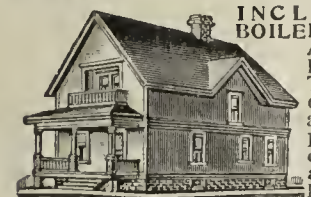
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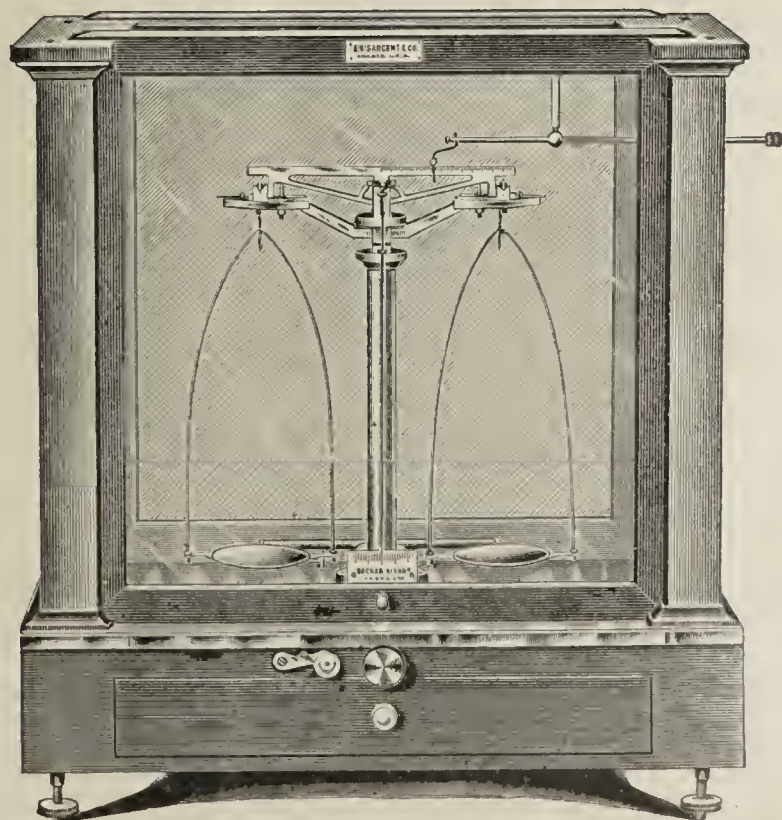
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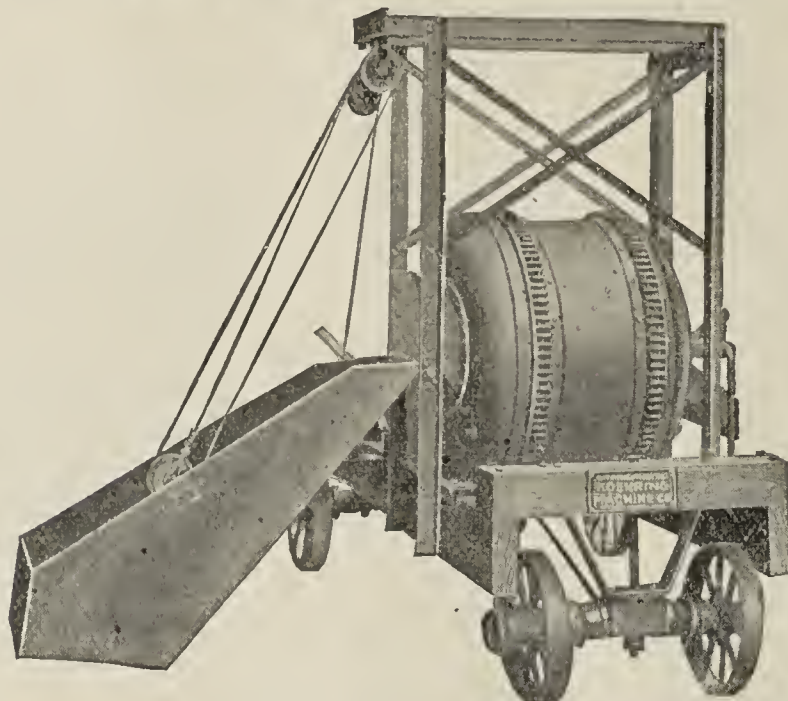
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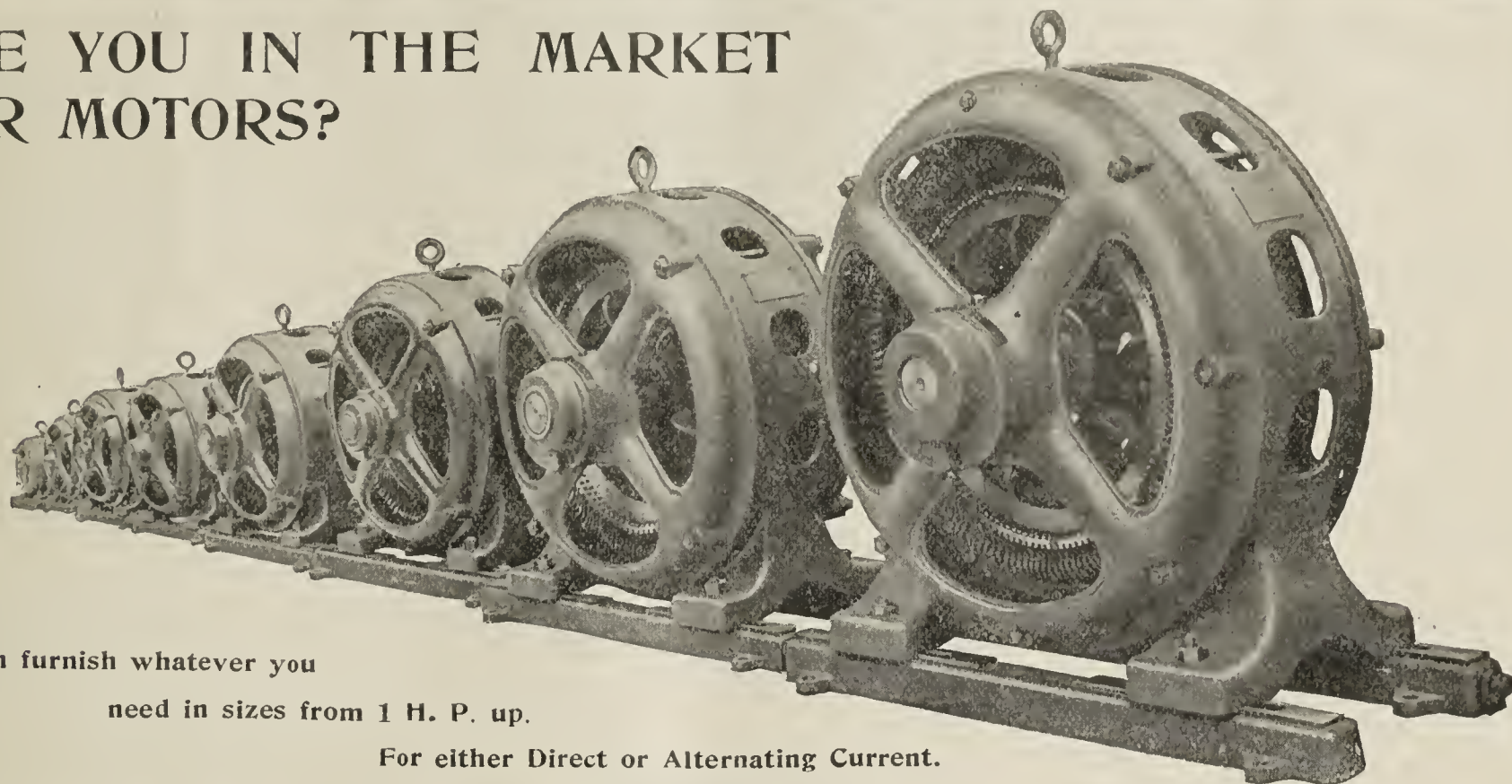
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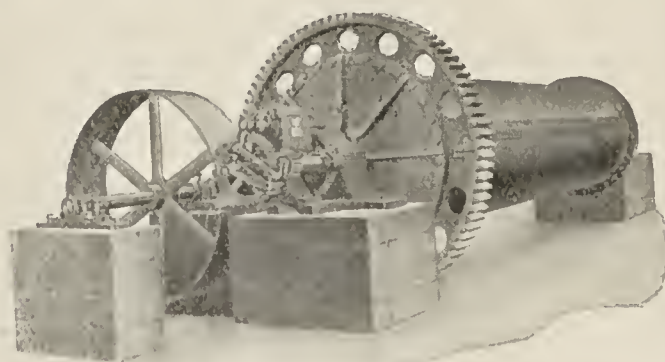
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<i>(By L. J. MENSCH)</i>		

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Advertisements in this column are inserted at the rate of two dollars per inch per issue—and no advertisement will be taken less than two dollars and must be paid strictly in advance.

WANTED—Position by skilled chemist with technical training and six years practical experience. Address Box A, Care of Cement & Engineering News.

CHEMIST With 6 years' extensive and successful experience with wet and dry processes, desires change of location. Have used all cement materials and fuels. References from past and present employers. Address M. M. B., care Cement & Engineering News.

CHIEF CHEMIST—Chemical engineer and "Cement Expert," technical graduate, with six years' successful experience in cement laboratories and mill. Also experience in installing new laboratories, desires to make permanent connection. Best of references. Address Q. D., care Cem. & Eng. News.

SUPERINTENDENT—Chemical engineer, and cement expert, competent to take full charge; can furnish a full crew of practical and high grade operatives, chemist, master mechanic, chief engineer, foreman, machinist, and ten good mill men. Desires to communicate with new cement company or others needing experienced men. Best of references. Address Q. D., care Cement & Engineering News.

The Board of Control of the City of Norfolk, Va., has requested Asst. city engineer of Norfolk, to prepare plans and specification for three concrete bridges, over Smiths Creek. The frequent repairs to the old wooden bridges have become so large, that it will be economy to erect permanent structures.

The plant of the Lehigh Portland Cement Co., at Belleville, Ont., Canada, recently completed, and with a capacity of three thousand barrels a day, is now actively engaged in manufacture. The plant is an up-to-date one in every particular, and is prepared to make shipments either by rail or water. The Thorn Cement Co., Continental Life Building, Toronto, are the sole selling agents for Lehigh cement.

The Chicago City Railway operating the surface lines, has submitted a plan for the construction of a concrete tunnel under the Chicago river at La Salle St., to cost \$1,000,000. The old tunnel at the same place will be removed. Another tunnel by the same company is to be built at Washington St. Work on this tunnel cannot be commenced until the plans for



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THE JEFFREY MFG. CO., Columbus, Ohio, U. S. A.

New York, Chicago, Boston, Pittsburg, Denver, Charleston, Knoxville, St. Louis, Montreal

the new \$20,000,000 depot are completed.

The Wabash Road will construct its local passenger stations of concrete, including walls, roof and platforms and floors. The wooden buildings will be plaster coated on expanded metal. The California mission style of architecture will prevail.

The Elk Rapids Cement Co., was badly damaged by fire on Oct. 27, caused by an explosion in the coal

grinding house, loss \$25,000. The fire could have easily been subdued with proper water supply which was lacking, the local municipal water plant which is operated by water power was for a time disabled by a log caught in the water wheel, before this could be removed the fire gained sufficient headway to cripple the plant.

The Monarch Portland Cement Co., works near Humboldt, Kan., claims to have struck a new gas well, daily capacity 20,000,000 feet.

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(COPY)

June 5th, 1908.

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**READ THIS LETTER
(COPY)**

April 6, 1908.

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Gentlemen.

Replying to your communication of the 2nd, our Griffin Mills are giving us perfect satisfaction.

We are using these mills on Portland Cement clinker and are grinding to a fineness of 95½ through 100, using a 40 mesh screen.

We are averaging from 5½ to 6 barrels an hour per mill. We trust the above will answer your inquiries.

Yours very truly,

Pulverizer Co.

BOSTON, MASS.

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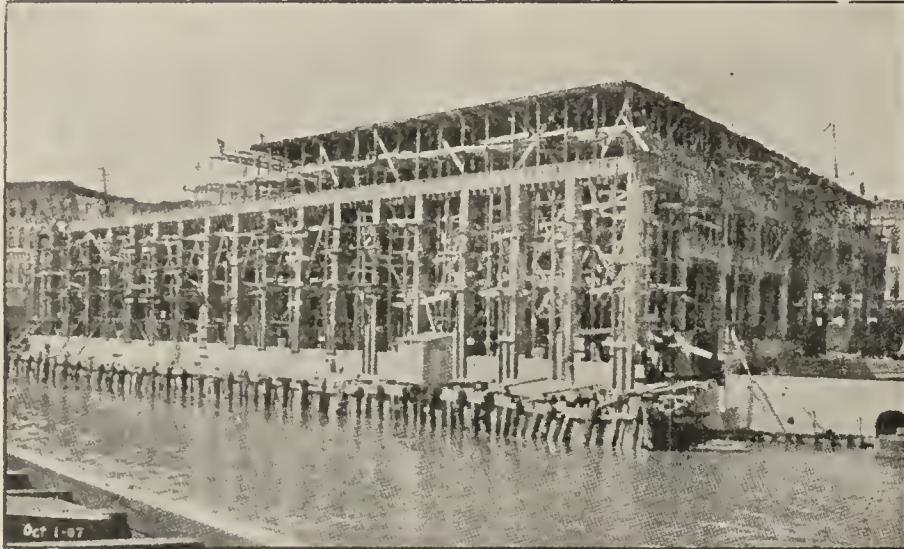
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Do not accept a substitute, as there are many adulterated compounds on the market.

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Write for free samples of our White Portland Cement



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Mechanical Engineer

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Designing and Constructing Engineers

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Are you equipped to get all the profitable business in your line? Take sewer pipe. \$34.50 will equip you with a 15" bell and pipe mold. This size is mostly used by road supervisors for culvert work. The profits on one hundred foot of his pipe sold at clay prices will pay for a mold. This is certainly worth investigating. Had you not better send your order for a 15" size today?

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PAUL O. COOK, Proprietor

Clarinda, Iowa, Dec. 17, 1906.

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Gents:—The tile molds I find to be just the thing. We had a good sale of the tile, it was late in the year to buy these tile molds but we had a good trade. We made about 3000 ft. of 12 in. tile; 2500 ft. of 15 in. tile; and about 1500 ft. of 25 in. tile. I think they are better than clay tile. They will stand frost better, and the older they get the better they are. A clay tile is no better than the day it is put in the ground—cement gets better the longer it is in the ground. I know this to be true; I have made clay tile for 16 years and am still making them.
Yours
PAUL O. COOK.

Miracle Pressed Stone Co.,

Largest Manufacturers of Concrete Machinery in the World
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Coal, Water and Good Labor

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Every Barrel Guaranteed

Fineness, Uniformity of Color
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No matter what kind of a structure you contemplate building, it will pay you to post yourself on the advantage of concrete construction made with

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The success of concrete construction depends largely on the quality of cement used. ATLAS is the highest grade of Portland cement manufactured.

This Company makes but one quality—the same for everybody.

Tell your architect to specify ATLAS.—Ask your dealer for it. You will know it by the Trade-Mark.

Building Books **FREE** on Request.

As a guide to prospective builders we have published the following Books which will be sent **FREE** on receipt of postage:

Concrete Country Residence, postage 25 cents

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Extensive Deposits of Raw Material. Proximity to Large and Growing Markets. Low-Priced Fuel Supply.



THERE ARE several desirable locations for Portland Cement Plants along the Santa Fe, where the advantages enumerated are to be found. If you are interested you can secure full and detailed information by addressing this office.

The SANTA FE is glad at all times to co-operate with those seeking locations or desirous of investigating conditions in territory tributary to its line. Correspondence from interested manufacturers is invited.

WESLEY MERRITT, Industrial Commissioner A., T. & S. F. Ry.
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The manufacturing of Concrete Blocks is rapidly nearing perfection, but the up-to-date manufacturer must use modern machinery and employ improved methods. Three features are important in perfect block making:

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With our **TRIPLE TIER RACKING SYSTEM** green blocks can be stacked three high direct from machine with inexpensive home-made rigging. This economizes space, reduces off-bearing distance, and above all insures slow, even, damp, perfect curing and bleaching. Plans and blue prints free to customers.

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ENGINEERING NEWS



HUDSON TUNNELS IN NEW YORK

With Portland Cement.

CEMENT AND ENGINEERING NEWS

(PUBLISHED MONTHLY)

WILLIAM SEAFERT, Editor and Publisher

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JOHN F. WALDRON, Advertising Manager

CHICAGO, DECEMBER, 1908.

CORRESPONDENCE.

We solicit correspondence on all matters of general interest to the cement trade in all its branches. Engineering notes, public improvements, and facts and opinions drawn from practical experiments will be welcome.

CEMENT CONVENTION DATES.

The National Association of Cement Users' Fifth Annual Convention at Cleveland, Ohio, January 11 to 16, 1909, Exhibition Hall, Central Armory. Convention Hall, Hotel Hollenden.

Cement Products Exhibition Co., 2nd Annual Cement Show, February 18 to 24, 1909, at the Coliseum, Chicago.

Northwestern Cement Products Association Exposition, March 2, 3, 4, 1909, at The Armory, Minneapolis, Minn.

CONCRETE BUILDING EXPERTS IN DEMAND.

James Knox Taylor, Supervizing Architect of the U. S. Treasury states that while the Government is able to obtain any number of superintendents for ordinary building construction work, it has been difficult to secure competent cement experts to superintend concrete work, and that he would favor a much more extensive use of concrete, if it were possible to obtain a sufficient number of experts to take charge. The reason why the Government is unable to secure suitable cement construction experts, is first, the compensation is not sufficient. Private contractors as a rule pay more liberal salaries than the Government offers for this class of talent. Then, again the red tape examination which the applicant is required to go through with in order to be placed upon the eligible list, from which vacancies are filled, does not insure immediate employment; this is another drawback; it may require weeks to obtain a Government position after the examination has been passed. There are too many other openings for the competent cement expert which can be closed by correspondence inside of a week, in answering advertisements appearing

in Engineering journals, or upon personal application which can be closed in an hour. Government work should be performed under an Engineering Bureau in connection with the supervising architect's office, from which superintendents could be drawn for carrying on concrete work. This groping about to find competent cement experts, shows a lack of organization in the department in charge of public work, executed by the Government. When the Government constructed the large concrete cold storage plant for the U. S. Army at Manilla, P. I., the Quarter-master selected the experts without the intervention of the civil service commission. The large reinforced concrete contractors experienced the same difficulty in securing competent supervision for work in hand, but they met this difficulty by establishing schools of instruction, in which men were trained in order to qualify them to take charge of just such work as the supervising architect of Government work would like to carry on, and cannot for this want of competent experts. Congress should be asked for an appropriation to establish such a school, to train men in the art and science of concrete work for the special benefit of the supervising architects of the department of Government. Meanwhile, there are many competent civil engineers that could be employed to take charge of any government work the architect has in sight, which would be improved by substituting concrete for other materials of construction.

A NEW LOCATION.

The Great Lakes Portland Cement Co. which acquired the property of Great Northern Portland Cement Co. at a judicial sale, will dismantle the old Great Northern Portland Cement Works at Marlborough, Lake County, Mich., and remove the same to Charlevoix, Charlevoix County, Michigan, where the new company has acquired a 500 acre tract of land having an extensive water front on Pine Lake, which will be improved with docks for water shipment of its product, the land contains extensive lime stone deposits which have been drilled to a depth of 400 feet, a ten foot bed of shale covering a large area is likewise formed on the companies land. The new location is 139 miles north of Marlborough and 210 miles north of Grand Rapids, on the Pere Marquette Railway, which passes through the companies new building site. The Michigan Central Railway will extend its tracks to the companies proposed plant. The company is to receive a substantial commission from the city of Charlevoix in consideration for lo-

cating its plant at Charlevoix, The arrangement made with the Charlevoix board of trade and the company must be confirmed by a vote of the city of Charlevoix. The capacity of the plant is to be 2500 barrels per pay with provisions for future enlargement.

Another cement company is investigating this locality with a view to locating a second plant at Charlevoix.

At a meeting held at the works of the Allentown Portland Cement Company, at Evansville, Berks County, Penna., November 20th, 1908, Mr. Chas. A. Matcham, formerly General Manager of the Lehigh Portland Cement Company, was elected Vice-President and General Manager. The construction work of the Company is making good progress; part of the structural iron work is erected. Three 24" x 48" x 42" Cross Compound Condensing Engines have been contracted for with Robt. Wetherill & Co., Inc., of Chester, Penna. Also four 8' x 120' Rotary Kilns, three Rotary Dryers, and four Rotary Coolers were ordered. It is expected these works will be in operation by next June.

The Fuller Engineering Company, of Allentown, Pa., are the Constructing Engineers.

The Chanute Cement & Clay Product Company of Chanute, Kansas, are installing 35 single Roll Griffin Mills. The sale was made by W. D. Phillips the present representative of the Bradley Pulverizer Co. This plant is to be in operation early in 1909.

The Italian Navy Department has placed an order for a number of 100 ton concrete barges, with double walls reinforced with steel rods, watertight compartments, divide these barges the same as in large ocean going ships.

MR. ELLIS SOPER OF DETROIT, MICH.

"Mr. Ellis Soper has resigned the position of Vice-Pres., of the Hunt Engineering Company, Iola, Kansas, and Supt. of the Dixie Portland Cement Company, South Pittsburg, Tenn., to become President of the Soper Company with headquarters at 1110-11 Ford Bldg., Detroit, Mich."

"The Soper Company with offices at 1110-11 Ford Bldg., Detroit, has been organized for the purpose of dealing in all standard cement machinery and doing general cement engineering work.—Officers, Ellis Soper, Detroit, Mich.; Pres. H. G. Hamilton, Youngstown, O.; Vice-Pres. W. J. Thompson, Youngstown, O.; Sec. & Treas."

ROBERT W. HUNT & CO., ENGINEERS.

Robert W. Hunt & Co., the well known engineers of Chicago have just issued a very fine booklet which they are sending out to architects, engineers, contractors, cement manufacturers and other users of cement, and which contains a summary of services offered by this well known house, in connection with the tests and inspection of cement and cement products. Robert W. Hunt & Company, maintain thoroughly equipped cement laboratories at all their various offices, Chicago, New York, Pittsburgh, St. Louis, San Francisco, Montreal and London. In addition they have experienced cement testers located permanently at many of the cement mills throughout the country. With this organization they are thoroughly competent to inspect and test cement.

They are prepared to inspect and test cement in carload lots at mills or warehouses or when delivered on the work, assuring to the purchaser a sound cement of a strength and fitness for the use intended. The service involves the proper sampling of the cement, the testing of the cement, and the final tagging (when necessary) of the accepted material.

When the cement is to go forward direct from the mill to the job, the sampling may be done at the mill. As the manufacturer will generally hold the car for 24 hours after loading pending the result of the soundness test (boiling test), the strength tests are under way while the car is in transit. This means that in most cases the results of the 7-day tensile tests are known by the time the cement reaches its destination. Besides enabling the purchaser to use his cement sooner, this arrangement reduces the amount of storage space necessary at the job.

The usual method of sampling is that embodied in the Standard Specifications recommended by the American Society of Civil Engineers. This method involves the drawing of one sample from each 10 barrels or the equivalent. This is done either as the cars are loaded at the mill, as the cement lies in the warehouses, or as it is received and stored on the job.

The testing may be done at any one of the laboratories of Robert W. Hunt & Co., or by their representatives in the laboratories of the cement mills.

On each sample tests are made for setting time and tensile strength and on an average sample representing each carload or lot, tests are made for fineness of grinding and soundness (boiling test). The tensile tests are made both on neat and sand briquettes

for periods of either 24 hours and 7 days or for periods of 7 and 28 days.

On the completion of satisfactory tests certified reports of the tests are supplied to the user and where necessary the accepted cement is tagged with Robert W. Hunt & Co.'s tags which bear serial numbers for identification.

They maintain a large force of trained and experienced concrete inspectors. These men are furnished as superintendents on any concrete work and their services assure a proper proportion of cement, gravel and stone, with a thorough mixture and good workmanship. In the case of reinforced concrete work, their services in addition assure a proper location of all reinforcements. They also maintain a large staff of competent and experienced engineers prepared to supervise and make reports of the tests of floor beams and slabs, columns and arches.

They are prepared to examine and report on existing structures with reference to condition of material, strength and workmanship.

Bids were recently opened by United States Engineer Jervey at Mobile, Ala., for the construction of a lock and dam, to be known as No. 16, and lock house on the Black Warrior, forty miles above Tuscaloosa, Ala. The bidders were B. H. Hardaway Co., of Columbus, Ga., \$428,625; R. C. Storrie, Philadelphia, Pa., \$481,600, and the Dravo Construction Company, of Pittsburgh, Pa., \$454,548. The bids for the lock tender's house were submitted by B. H. Hardaway, \$3,000; R. C. Storrie, \$3,200, and the Dravo Construction Company, \$3,500.

The conditions of the contract are that the work shall begin within sixty days after the awarding of the contract and shall be completed within five hundred working days. The bids have been forwarded to Washington, with the bid of B. H. Hardaway, recommended for acceptance.



Robert W. Hunt,
President of the Robert W. Hunt Co., Engineers, Chicago.

EXPLANATION RELATIVE TO DE-COMPOSED CONCRETE.

In your October issue Cement and Engineering News, page 252, you have an interesting, illustrated article, "An example of the Decomposition of Concrete in Sea Water."

As an apology for intruding my views on you at this time, I beg to state that my experience in connection with concrete extends over a period of twenty-two years, and I am fearful that this article, if not explained, will cause some "doubting Thomases" to become more skeptical than ever, and as I have spent a good many years of my life teaching concrete as a business, I feel that I would not be true to myself or the best interests of Cement Concrete if I did not raise my voice to point out the evident reason why this concrete pier is failing.

I notice that the specifications named in the article call for a 1 to 1 3 in. facing on all exposed surfaces, immediately beneath which the concrete mass is supposed to be composed of a mixture of 1, 2 and 4, the aggregates being presumably sand and gravel mixed after the manner of dry concrete, and "well rammed;" for the purposes of further illumination of the conditions, I regret that the sizes of the aggregates are not mentioned.

In the first place it is a mistake to attempt to surface an ordinary concrete mixture with a very rich mortar facing, particularly when the same is exposed to the elements, and as in this case, to the abrasion of large masses of ice and other floating objects, for the facing is very apt to be cracked in case of the unequal expansion and contraction of the two different mixtures particularly when these especially trying conditions prevail.

It is also evident that the dry mixture of concrete, notwithstanding it was supposed to be well rammed, would still have many small voids which would permit the permeation of water, and in a climate subject to low temperatures, and repeated and frequent freezing, would certainly rapidly disintegrate such concrete.

If the concrete had been made of properly sized aggregates to fill all natural voids, with sufficient cement to properly bond the same, and placed in a position so wet that there would be no doubt about its being well settled in place, the voids above mentioned would be less likely to occur, and I am confident that the failure of this concrete structure is due principally to the

voids in the concrete and to the repeated freezing temperatures to which this porous concrete has been exposed.

Therefore I claim that to guarantee permanency in concrete exposed to the conditions of this dock, it must be practically free of voids and absorb a minimum quantity of water, which is evidently not the case in the instance of the Dock at the Charlestown Navy Yard, and I am confident that this is the practical reason of the failure of this work, and in no sense can the failure be ascribed to the action of sea water as the results would undoubtedly have been the same had it been fresh water.

Yours truly,

H. A. Miner, President,
Steel Protected Concrete Company,
Philadelphia, Pa.

The dam at Bellows Falls, Vermont, building by the Aberthaw Construction Company, Boston, Mass., from designs by Chas. T. Main, Mill Engineer and Architect of the same city, has been completed. This dam is 600 feet long and about 40 feet high in the deepest part. Work was started the first of August and the last concrete was placed November 25th. The construction was progressed rapidly on account of the Connecticut River being lower this summer than at any time in thirty-five years past. The dam is built just below an old leaky crib dam, and the problems of construction were the handling of the leakage by building a large cofferdam to hold back the water from the deeper places, and the economical handling of concrete. An unusually efficient contracting plant was erected making it possible to use much less equipment than is usual in most work of this kind. This dam supplies power to various mills at Bellows Falls, most of it being used by the International Paper Company.

The Parsons Pulp & Paper Company, of Parsons, West Virginia have closed contract with the Aberthaw Construction Company, Boston, Mass., for constructing a reinforced concrete digester house. The building will be one hundred feet high and will carry a chip bin at the top of which two digesters will be directly fed. This contract is evidence of the consistent policy of this company in replacing much of

the wooden construction of its plant with concrete.

Mr. H. D. Waldron, formerly of Bowling Green, Ohio, has accepted the management of the Lincoln Bates Valve Bag Company, with headquarters in Cleveland, O., which is a subsidiary of the parent company, the Bates Valve Bag Company of which Adelmer M. Bates is the president and inventor.

Mr. Waldron is a well known business man and his success in this new enterprise is assured. He will interest the cement, gypsum and plaster manufacturers of Ohio, Virginia and West Virginia in the adoption of the Bates system for filling their bags.

The Bates system for packing cement was installed recently in the new mill of the Texas Portland Cement company at Dallas, Texas. This system is a very clever plan of filling bags that are sealed up when filled. A cut of the machine appeared in our November issue. By this plan three men can fill, weigh and load into the car from 900 to 1200 barrels of cement in one day at one third of the expense, this being the work of eight men by the old system.

The Roosevelt Dam & Cement Plant on the Salt River, Arizona, 12,300 cubic yards of masonry was laid in October, bringing the lowest point of the dam to an elevation of 60 feet above low water mark. 45 per cent of the masonry of the dam were in place in October. The cement mill ran 24 days producing 11,300 barrels of clinker of which 9,700 barrels were ground into cement 75 per cent of the entire project is now completed including the power transmission and irrigation canals, which are now in partial operation.

The Pembind Portland Cement Co., which manufactures a high grade natural cement at Concrete, N. Dakota, will double its output, The N. Dakota Ry., a new line has been extended to the plant.

The Building Code of the City of Chicago is to be thoroughly revised. The City Building Commissioner Mr. Murdock Campbell, says: "the growing use of cement construction will be recognized and sections in the new code will be framed to allow its use, where any one desires."

TEST OF A REINFORCED CONCRETE FLOOR SYSTEM.

An interesting and valuable report of a fire, load and water test upon a triangular reinforced concrete floor system, constructed by the American Steel & Wire Company, at the fire-test station, Columbia University, New York, has been issued. The test was conducted by Ira H. Woolson, E. M., Adjunct Professor of Civil Engineering, in co-operation with the City Building Bureaus. The test was made in strict accordance of the specifications of the New York City Building Bureau and the installation of the

Two types of floor arches were tested, one with a span of eight feet and the other a span of five feet.

The eight foot span occupied the south side of the test chamber and was made of cinder concrete five inches thick, reinforced with the metal fabric of the American Steel & Wire Company, known as Style No. 38. The disposition of which is indicated in photograph No. 1. This metal fabric consisted of three twisted strands of No. 4 steel wire, spaced and secured every four inches by No. 12½ diagonal steel cross wire.

ches above the bottom surface of the concrete.

The 8 ft. span was supported by 12" No. 40 I beams, and the five ft. span by 10" No. 25 I beams. These beams were protected by two inches of concrete below the bottom flange of the beams, and one and one-half inches of concrete at each side of the lower flanges.

The concrete was held in place by American Steel & Wire Company's fabric, style No. 8, consisting of one strand of No. 12½ wire secured in every four inches by fourteen diagonal cross wires.



Triangular Reinforcement, made by American Steel and Wire Co., Chicago.

partitions, as well as the test, was at all times under the direct supervision of its engineering staff.

The test was conducted in test house No. 2, which is a reinforced cinder concrete structure 14' x 20' on the inside. It is supplied with six suitable chimneys at the top and draft openings through the wall at the bottom. The fire grate is located 2' 6" above the ground level.

The floor construction under test formed the temporary roof of the test house. The under side or ceiling being 9' 6" above the grate.

The five foot span occupied the north side of the test chamber and was made of cinder concrete four inches thick, reinforced with American Steel & Wire Company's fabric, Style No. 23. The metal fabric in this span consisted of one strand of one-quarter inch steel wire, spaced and secured every four inches by diagonal wires the same as in the fabric of the eight foot span. The character of this fabric can be seen in the middle of photograph No. 1 where it laps over the two central beams. The fabric in the spans was placed 1½ in-

The concrete used in the construction was a 1:2:5 mixture of Portland cement, clean sharp sand, and boiler cinders.

Specimen blocks of this mixture were made at the time that the material was being placed, and were tested for strength when about eleven weeks' old. They gave an average value of 1,000 lbs. per square inch.

The five ft. span was put in place December 18, 1907, and the eight ft. span on January 25, 1908. The former was therefore about eleven weeks old, and the latter six weeks at test.

Owing to the fact that it was stormy and freezing weather most of the period the concrete was setting, a salamander was kept burning in the test building the greater portion of the time.

The purpose of the test was to determine the effect of a continuous fire below the floor for four hours at an average temperature of 1700° F., the floor carrying at the same time a distributed load of 150 lbs. per square foot; at the end of the four hours the under side of the floor (or ceiling) while still red hot to be subjected to a $1\frac{1}{8}$ " stream of cold water at short range, through 100' of hose under 60 lbs. pressure at the nozzle for five minutes, then the upper side of the floor (which forms the roof of the test building) to be flooded at low pressure; afterwards the stream to be again applied at full pressure on the under side for five minutes longer.

Deflection of beams and floor to be measured continuously during the test. The load then to be removed and after the floor becomes cold, it shall be reloaded to 600 lbs. per square foot and deflections noted.

The water was applied by firemen with an engine detailed for the purpose and under the direction of Battalion Chief Edward S. Root. Sixty pounds was maintained at the nozzle. Through an error the firemen brought with them a $1\frac{1}{4}$ -inch nozzle instead of the regulation $1\frac{1}{8}$ -inch diameter, which made the stream somewhat more severe than usual. In applying the water the stream was thrown back and forth over the whole ceiling as much as possible, and not allowed to strike continuously on one spot. After five minutes application the pressure was reduced to about thirty lbs. and the top of the floor flooded, then the stream was applied to the ceiling again at full pressure for five minutes longer. Total time of application at full pressure was ten minutes.

About one hour after starting the fire three cracks appeared on the top of the floor or roof of the building. Two of these cracks were parallel with and nearly over the two supporting beams of the 8-foot span, and the third was similarly located along the middle beam of the 5-foot span. These cracks gradually opened during the test to a maximum width of about $\frac{3}{32}$ of an inch. Some water boiled out of the concrete and ran out upon the roof. During the latter part of the test a few small diagonal cracks developed near the ends of the beams and ran across the floor slabs towards the middle of the span.

All of these cracks were evidently due to expansion. They appeared to be on the upper surface only. The underside of the floor or ceiling of the test chamber was in perfect condition so far as could be observed up to the application of water. The water scored the surface somewhat in front of the doors where its action was most severe, but only to a depth of about one inch as a maximum. Considerable of the concrete thus washed out was along the line of the cracks between the centering boards where the cement had evidently been carried away by the escaping water at the time the floor was placed. This is a defect that could be easily avoided.

The wire mesh encasing the bottom of the middle I beam of the eight-foot span was exposed for about three feet near the middle of the beam, and the flange of the beam itself was bare for eighteen inches. This was the only metal exposed by the application of water.

There was one crack four feet long in the central portion of the eight-foot span about one foot from the middle beam and running parallel with it.

There were several small cracks across the bottom of the beams, but the concrete remained firm and secure.

As a whole the ceiling was in excellent condition at the completion of the test.

The maximum deflection at the middle of the eight and five-foot span during the fire was $1\frac{1}{32}$ and $1\frac{1}{16}$ inches, respectively. The larger part of this was recovered when the floor cooled, and the application of the final load of 600 lbs. per square foot increased the deflection on the larger span only $\frac{3}{16}$ inch, and on the smaller, $\frac{1}{16}$ inch. No new cracks developed as a result of the loading, and there was no evidence that the floor was distressed.

The total permanent deflection of the two spans after entire removal of load was $\frac{3}{8}$ inch for the eight-foot span and $\frac{1}{4}$ inch for the five-foot span.

The test was conducted in co-operation with the Bureau of Buildings of New York, and the installation of the floor was observed by representatives from the Bureaus in the various Boroughs, also from Philadelphia.

The test was witnessed by the following Building Bureau Engineers; A. Schwartz, Borough of Manhattan; H. Vanatta, Borough of Bronx; Harry Brown, Borough of Richmond; W. G. Button, Bureau of

Building Inspection, Philadelphia, Pa.; Spencer B. Hopkins, Bureau of Buildings, Providence, R. I.

The American Steel & Wire Company were represented by T. H. Taylor, New York Office; H. S. Doyle, Chicago Office; L. A. Dietrich, New York Office; R. H. Pratt, New York Office and several others.

A large number of spectators were present, among them, Rudolph P. Miller, Consulting Engineer, 527 5th Avenue, New York; Col. Hodges, Chief Engineer, Isthmian Canal Com., Washington, D. C.; R. Allworth, Assistant Chief Engineer, Washington, D. C.; Major Langfitt, U. S. Engineering Corps, Washington, D. C.; G. H. Stewart, Representative, Ins. Engineer, 120 Liberty Street, New York; G. E. Stecher, Representative Ins. Press. 56 Cedar Street, New York; H. R. Leonard, Engineer, Pennsylvania Railroad, Philadelphia; J. F. Murray, Engineer, Pennsylvania Railroad, Philadelphia.

The official approval of the system by the Superintendents of Buildings of all the various Boroughs, together with those of Philadelphia, Pa., and Providence, Rhode Island, are attached as an appendix to the report.

In order to standardize a lighter fabric a second test of a floor similarly reinforced was made by Professor Woolson on October 8 and has received the approval of the building department.

The City of Peoria, Ill., was improved with about 12 miles of cement sidewalk during the season of 1908, 383 feet of brick walk were laid during the same period.

The War Department purchased 500 young horses in Australia for use in the Philippine Islands, after training them at the large army post at Manila, they are distributed to other points in the Islands. The present showing indicates that these Australian horses do not compare with the horses sent from the United States, as the Australian horses will not stand the fatigue of forced marches.

The Burt Portland Cement Co., is enlarging its plant, the new addition will cover 76x72 feet, the building is to be cement and steel, with structural steel roof.

ENAMEL FOR CONCRETE BRICK.

Frequently attempts have been made to replace the dull surface of concrete blocks and concrete brick by something more pleasing to the eye; however with little success until recently. That it is so difficult to apply materials of a high luster to concrete is due to the fact that concrete can not be heated to the same high temperature as clay brick, which later can be coated with glass enamels or porcelain enamels, while later exposed to red heat. For concrete, therefore, enamels have to be composed of materials which do not require high temperatures. Such enamels are put on the market by Mr. Paul Fuchs, 611 Carmen Ave., Chicago, who is a specialist in this line. He invented a process, by which concrete brick as well as clay products can be enameled without calcining them. The blocks or brick are merely heated to a temperature up to 500 Fahrenheit or in other words the enamel is baked on instead of being vitrified or fused.

The results obtained by Mr. Fuchs' process are very similar to porcelain—enameled clay brick, which later sell for from \$80.00 to \$120.00 a thousand and cost about \$60.00 to manufacture on account of the high percentage of refuse. Concrete brick coated with this special enamel, on the other hand, cost about \$12.00 a thousand to manufacture, brick, enamel, labor of enameling and heating all included. They can easily be sold for \$25.00 and upward, and for this reason are strong competitors of porcelain-enameled clay brick.

At this laboratory Mr. Fuchs enamels, free of charge, samples of concrete brick sent to him from all over the world and returns them to the manufacturer. The reason why he demands samples of brick from the producer instead of supplying the concrete manufacturers with samples of enamel, with which to experiment, is due to the fact that the enameling requires some skill and the necessary outfit. Thus the manufacturer is supplied with samples of enamel applied in the right way to his own concrete brick. Thereby he is placed in the position to submit the enameled brick to whatever tests he chooses to make. Afterwards, he receives, upon placing an order for enamel all necessary instructions for the proper application of the enamel and for the heating devices. This heating is done in a baking oven or spacious brick or concrete chamber which is raised to the proper temperature by means of gas, steam pipes or elec-

tric heaters. The first cost of such ovens is within the means of the smallest concrete block manufacturer, and workman are easily trained to enamel the brick in the proper way and at a minimum cost. The expense of heating is a mere trifle, if the brick are enameled by the thousand.

The point which is of the greatest importance for the concrete brick manufacture is to obtain a dense brick with a smooth surface as this requires the smallest amount of enamel. Moreover, the brick must be well seasoned lest they become fissured in the enameling process. How to obtain best results Mr. Fuchs is in a position to tell the concrete manufacturer, to many of whom he has given valuable hints.

PACKING CEMENT IN VALVE BAGS.

Mr. Wm. Scott, who for several years has had charge of the packing and shipping department of The Lawrence Cement Co., at Seigfried, Pa., called at the office of Cement and Engineering News on December 1st while on his way to the Pacific Coast, on an extended pleasure trip.

Mr. Scott says the Lawrence Cement Co., installed the Bates valve bag filling system in their plant early last summer that they have been able to pack and load with one machine and three men as high as 1500 barrels of Portland cement in one day. This is about three times as much cement as these three men could pack under the old method. The Bates Cotton bags are machine tied, before being filled, which greatly reduces the consumption of string. The paper cement bags require no tying or other closing, no string being required to these bags. This method of tying has done away with complaints from consignees of bags coming untied.

Mr. Scott advises us that aside from the saving of labor and twine it is a great help in facilitating shipments especially for railroad and vessel shipment. The inspectors who desire to get away with cars or barges will request that the valve bag packers be used.

HYDRATED LIME.

The Marblehead Lime Co., of Chicago and Kansas city, has issued an instructive pamphlet on the use of Hydrated Lime in cement mixtures, which will be sent to cement users on request.

The Sandusky Portland Cement Co., of Sandusky, O., are supplying

their White Portland Cement for use in the following important contracts:

Swift's Engineering Bldg.; Northwestern University, Chicago.

For exterior Stucco finish on the White Garage, San Francisco.

For exterior stucco finish on the new Taylor Residence at Clairmont Park, Cal.

For pointing Bedford Stone on the new Temple Israel, St. Louis.

For the House Office Bldg., Washington, D. C.

The same company are supplying Medusa Waterproof Compound for the following important work:

Studebaker private residence at South Bend, Ind.

People's Gas, Light & Coal Co., receiving pit, Chicago.

U. S. Navy Yard, Puget Sound, Wash.

Nevada Ice & Cold Storage Plant for So. Pacific Ry. Co.

Auditorium Swimming Tank, St. Louis, Mo.

For cement roofs on planing mill and power house at Wausau, Wis.

PRIZE COMPETITION FOR A CONCRETE SUBURBAN HOUSE.

The Universal Portland Cement Co., will distribute \$300 in cash in a prize competition for plans and specifications for a suburban concrete dwelling house, first prize \$200.00; second prize, \$75.00; third prize, \$25.00 open to all architects and architectural draftsmen residing within 50 miles of Chicago all drawing must be completed and delivered to the rooms of the Chicago Architectural Clubs, 84 Adams St., Chicago, before 5 p. m. Dec. 17, 1908 the awards will be announced on Dec. 21, 1908. The prize drawing to become the property of the Universal Portland Cement Co. Full particulars to be had from the Chicago Architectural Club at above address.

CEMENT KILLS PRIZE TROUT.

Mr. Thomas Windle of Coatesville, Pa., reports that while making repairs to his dam, which impounded several thousand prize trout, the trout commenced to die, caused by the use of new cement in the concrete of which the dam was being constructed. The fish were dressed and salted down for winter use.

The Union Portland Cement company of Ogden has completed plans and specifications for the new plant to be erected at Tridon, Mont. P. T. Linehard of New York City, has arrived at Salt Lake City, Utah, and will take the plans north and commence construction work without delay. The new company will be known as "The Three Forks Cement Co." This plant will have an ultimate capacity of 1,200 barrels per day. Cottages to harbor the working force have been constructed.

THE CLAYS OF TEXAS.

Bulletin No. 102, just issued by the University of Texas, bears the title "The Clays of Texas." It contains the results of an exhaustive study of the economic value of the various clays of the State by Dr. Heinrich Ries, Professor of Economic Geology in Cornell University, and author of "Clays, their occurrence, properties and uses."

The report consists of two parts. Part I, pages 1-64, deals with the "Origin and Occurrence of Clays," and Part II, pages 65-316, deals with the "Economic Geology of the Texas Clays." There are 316 pages, ten full-page plates, and the book is bound in paper.

Samples collected from many clay deposits in the state have been subjected to numerous physical tests and chemical analyses in order to bring out their values. These tests have demonstrated the existence of a large number of deposits adapted to various economic uses. An important belt of fire clay is shown to extend from Bexar county to Bowie county, while in the bituminous coal region of northern Texas there are shaly clays well adapted to the making of paving brick.

A copy of the bulletin has been sent to each well established public and institutional library in Texas, and to such libraries and institutions in other states and countries as exchange publications with the University of Texas Library. A copy will be sent to anyone on receipt of the price, \$2.00. Address the University of Texas Bulletin, Austin.

The cement testing section of the U. S. Reclamation service besides making regular tests of cement for the various western reclamation projects has been making waterproofing tests relating to concrete, which are still under way.

HOW RUSSIA OBTAINS NAVAL STORES.

A glance at the way in which naval stores are obtained in Russia serves to show what is likely to happen in this country when the longleaf pine forests, from which our naval stores industry derives the raw material for turpentine, resin, tar, and pitch, have been depleted.

Red pine, called by the botanists *Pinus sylvestris*, is the tree, which the Russians exploit for resin, as the longleaf pine of the Southern States is exploited in this country. In securing the resin the Russians chip the trees much as we do, but a far smaller yield is secured.

Each year's chipping extends about three feet vertically, and all the way around the tree except for a strip of bark about two inches wide, just sufficient to keep the tree alive. After five years' chipping this strip of bark is also cut and the tree soon dies.

On account of the coldness of the climate where the red pine grows, the resin does not flow readily, but hardens soon after it exudes from the tree. It is necessary, therefore, to expose a large surface in order to get a sufficient yield. Nor does the resin flow far enough to be caught in liquid form in "boxes" or cups, as it does in this country. Therefore it has to be scraped off after it hardens, the whole product, which amounts to only about two ounces a year from each tree, is comparable with the "scraps" which forms only a small part of the yield obtained in warmer climates.

Spirits of turpentine and resin are prepared from this crude resin by distillation with steam in the usual manner. The tree is utilized further than this, however. The outside slabs with scarred surfaces, to which some resin still adheres, are treated either in the old fashioned pit kiln or in closed iron retorts for the production of tar, charcoal, and wood turpentine. The rest of the tree is used for fuel and for making the barrels in which the products are shipped.

It is possible that after our southern turpentine pine becomes commercially extinct, some of the resinous trees of the colder parts of the United States may be utilized like the red pine of Russia as a source of naval stores, although the yield may be small and the process tedious.

BUREAU OF AMERICAN MANUFACTURERS IN EUROPE.

The new two-cent rate of postage put into effect October first between this country and Great Britain, has already had the effect of increasing the volume of such foreign mail by

100 per cent, according to a statement issued by Postmaster Morgan of New York.

To fill a need of American Manufacturers for better facilities abroad a "Bureau of American Manufacturers in Europe," has recently been organized, and is open to all reputable American firms.

This Bureau has leased a large six-story building in the business heart of London, England, and foreign buyers visiting that city will be invited to attend the exhibition of American goods which will be carried permanently.

A monthly bulletin will be sent to buyers in every quarter of the globe, personal letters will be despatched to them at frequent intervals, and every mode of advertising consistent with progressive business methods will be employed to make the exhibit a profitable enterprise for the members participating.

A staff of experienced salesmen will be engaged, possessed of mechanical educations in the lines to be demonstrated, writing rooms and private conversation rooms will be maintained, and buyers will be served as carefully and as thoroughly as would be possible at the home offices of the respective members.

The "Community" idea has been in vogue in Germany for many years, and has proven convenient for the buyer and profitable for the Manufacturer, but this is the first time that such an enterprise has taken root in England.

A comprehensive system of reports between Europe and America will keep the members in close touch with foreign conditions, and it is anticipated that a large increase in exports will attend this new movement.

Those of our readers who are interested may obtain full information by writing to the editor.

Export of Portland Cement to our insular possessions during 10 months ending October of the present year, was as follows:

To Porto Rico 90,160 barrels, value \$136,835.

To Hawaii, 30,852 barrels, value \$75,556.

To the Philippine Islands, 8,000 barrels, value \$9,600.

To Alaska, 2332 barrels, value \$6,208.

To Panama, 66,631 barrels, value \$111,346.

The Monarch Portland Cement Co., which has a plant under construction at Humboldt, Allen Co., Kansas, has purchased 480 acres of land in Sedgwick Co., Kansas, seven

miles southwest of Wichita. The purchase price being \$36,000.

The Southwestern States Portland Cement Co., plant now under construction at Dallas, Texas is to be completed May 1st, 1909, with a daily capacity of 3,500 barrels. Texas lignite may be used as fuel. The following officers and directors for the ensuing year were elected as follows: W. F. Cowham, Jackson, Mich., president, A. C. Stich, Independence, Kan., vice-president; Thomas C. Dinsmore, New York, second vice-president; W. H. L. McCurtie, Minneapolis, secretary; N. S. Potter, Jackson, Mich., treasurer; John W. Boardman, Jackson, Mich., auditor; Dr. C. H. Waggoner, Minneapolis; W. W. Hawley, Huntington, Ind.; C. E. Ulruchson, Jackson, Mich.; H. D. Breck, Minneapolis; Thomas E. Barkwith, Jackson, Mich.; H. D. Matham, chief engineer; R. M. Miller, assistant engineer, B. V. M. La Rue is superintendent at Dallas; T. R. Johnson, superintendent of construction.

CEMENT COMPANIES CONSOLIDATED.

The Union Sand & Material Co., of St. Louis, Mo., operating a cement plant, and the Kansas City Portland Cement Co., have consolidated.

The Kansas City Portland Cement Co., is capitalized at \$1,500,000.

The consolidated company will increase its capital stock \$400,000 and \$250,000 will be spent in the enlargement of the plant. This will mean a daily output of 3,000 barrels of cement, instead of 2,000, which is our present daily capacity. There will be no change in the management of the local plant, and most of its present officials will continue.

The Portland Cement Co. of Utah, S. M. Bailey, General Manager received a cable to start up the Salt Lake City Works, which has a capacity of 400 barrels per day. The plant was started up on Dec. 1st, 10 days after the receipt of the London, England Cable.

INCORPORATED.

The San Antonio Portland Cement Co., has granted a charter on Nov.

26th, under the laws of Texas, capital \$200,000. Incorporators are F. W. Cook, Albert Kroukasky, Charles Baumberger, Nic Behles all of San Antonio, Tex. The Henry S. Spackman have the contract for erecting the plant.

A Portland Cement Project is under way at Sandpoint, Kootenai County, Idaho, to be known as the Acme Portland Cement Co. The location at Sandpoint, is on the line of the Great Northern Ry., and Northern Pacific Ry. The Sandpoint business men agree to take or sell \$50,000 of the company's stock to secure the location of the plant in their town.

This is the same project described in our September issue promoted by Aman Moore of Los Angeles, Cal., who is the engineer and original promotor of the company. There are several towns on the Shore of Lake Pend Oreille Working for the location of the plant. R. K. Neill, President and E. C. Hadley, Secretary of the company.

The Lake Shore Cement Co., is building a mill just west of Sandusky.

Wm. J. Dingee, the leading cement manufacturer of the Pacific Coast has been compelled to pool all of his properties with the Crocker National bank of San Francisco, in order to raise funds to permit the operation of his cement plants. Mr. Dingee is the principle bondsman of Ex-Mayor Schmitz of San Francisco. It

is said that Schmitz may be compelled to obtain other bondsmen or go back to jail.

Wm. A. Crocker & John L. How of San Francisco and others are reported to have purchased the Santa Cruz, Portland Cement Co. The 400 employes of the company who quit work on account of the non-payment of wages, have been paid and resume work.

The new building code of the City of Cleveland, Ohio, is more liberal than under the old code, which restricted the height of concrete buildings to 4 stories, eight story concrete buildings can now be erected.

Certain stockholders of the White Cliffs Portland Cement & Chalk Co., brought suit against the late Peter Fahrney & Sons, the Guardian Trust Co., and others for an accounting on the charge of wrecking the Cement Co. The case was tried in Chicago in the Appellate Court, Judge Smith, Chytraus and Baker, sitting, affirming the decree of the lower court, which held that the charges were not substantiated and dismissed the case.

The Pan American Portland Cement Co., of Jersey City, N. J., has been incorporated, capital \$100,000, to sell, manufacture and deal in Portland cement, etc., S. A. Anderson, L. H. Gunther, and J. R. Turner all of Jersey City, Incorporators.

The Kansas City Portland Cement Company was purchased by the Union Sand & Material Co., of St. Louis, Mo.

IMPORTS OF CEMENT INTO THE UNITED STATES.

WHERE FROM	OCTOBER				TEN MONTHS ENDING OCTOBER			
	1907		1908		1907		1908	
	Quantity in lbs.	Value in Dollars.	Quantity in lbs.	Value in Dollars.	Quantity in lbs.	Value in Dollars.	Quantity in lbs.	Value in Dollars.
United Kingdom . .	59,937,005	\$198,954	.....	.....	198,277,021	\$700,226	62,405,210	\$236,775
Belgium	9,464,744	31,954	.....	.....	201,224,729	600,110	106,894,433	343,385
France	444,100	1,520	1,190,400	\$4,850	11,030,529	41,369	12,318,486	48,960
Germany	17,451,170	59,123	7,608,247	29,757	262,081,142	838,402	97,010,243	338,327
All Other Europe . .	1,920,250	6,620	510,935	1,543	2,850,513	8,749	1,889,983	6,641
British North Am. .	20,200	93	5,015,770	26,399	331,750	2,061	8,589,240	45,086
Other Countries . .	1,052,178	5,503	162,150	666	6,684,052	35,631	507,169	2,578
TOTAL	83,289,647	303,767	14,487,502	63,215	682,484,736	2,226,548	289,614,704	1,021,752
Domestic Exports of Cement, bbls. . . .	108,722	162,942	68,107	95,164	785,514	1,273,019	720,847	1,094,694

There were 22,167,022 lbs. of imported Roman and Portland Cement, etc., in the United States bonded warehouses in October, 1907, valued at \$68,517, against 10,735,788 lbs. in October, 1908, valued at \$33,295.

For ten months ending in October, 1907, there were 107,585 tons of asphaltum imported in the United States valued at \$414,623, against 114,989 tons imported in ten months ending October, 1908, valued at \$494,101.

A PERFECT POWER MACHINE FOR MAKING CEMENT DRAIN TILE.

The Miracle Pressed Stone Co., Minneapolis, Minn., who have perhaps done more than any individual or Company in promoting the universal use of concrete tile, sewer pipe and irrigation pipe, have perfected and added to their already extensive line a machine that will make perfect concrete drain tile at the very smallest possible cost. Those promoting the use of concrete tile have never had anything to contend with in the larger sizes, because they could compete with clay products and realize profits 100 per cent and more, and furnish the consumer a better article than clay. The difficulty is encountered in making the small size of concrete pipe from 4 to 12 in. in diameter rapidly enough and at a low enough cost so that clay pipe could be competed with and a reasonable profit realized.

The Miracle Pressed Stone Co., found it necessary to do a great deal of experimenting and studying to get a machine that would pack the concrete uniformly from end to end of the tile. It was necessary to construct a packer that would press the concrete out against the shell which forms the outside of the pipe,

and at the same time shear off the concrete as the packer was passing through the shell so that the inside would be smooth and uniform. These experiments have resulted in a packer that packs uniformly from end to end, and the Miracle Pressed Stone Co., are now in position to furnish the cement workers a machine that will not only make an absolutely perfect cement tile, but will make them at great speed and a minimum cost.

There is no structural angle iron work about this machine, which can get out of line, but it is built up from the bottom of heavy gray iron castings, and it is just as rigid and strong as a drill press.

The Company is in position to furnish blue prints of up-to-date plants for curing tile by steam, and their large sales force makes it convenient to have a representative call on anyone interested and explain to them in detail the cement tile business, proper arrangement of machinery and buildings, etc.

It is a safe assertion that fully 25 per cent of the counties in the United States will support a business of this kind and furnish a market for all the tile that can be manufactured on one machine, and those in position to handle a proposition

of this kind will have no trouble in realizing very nearly 100 per cent on the investment.

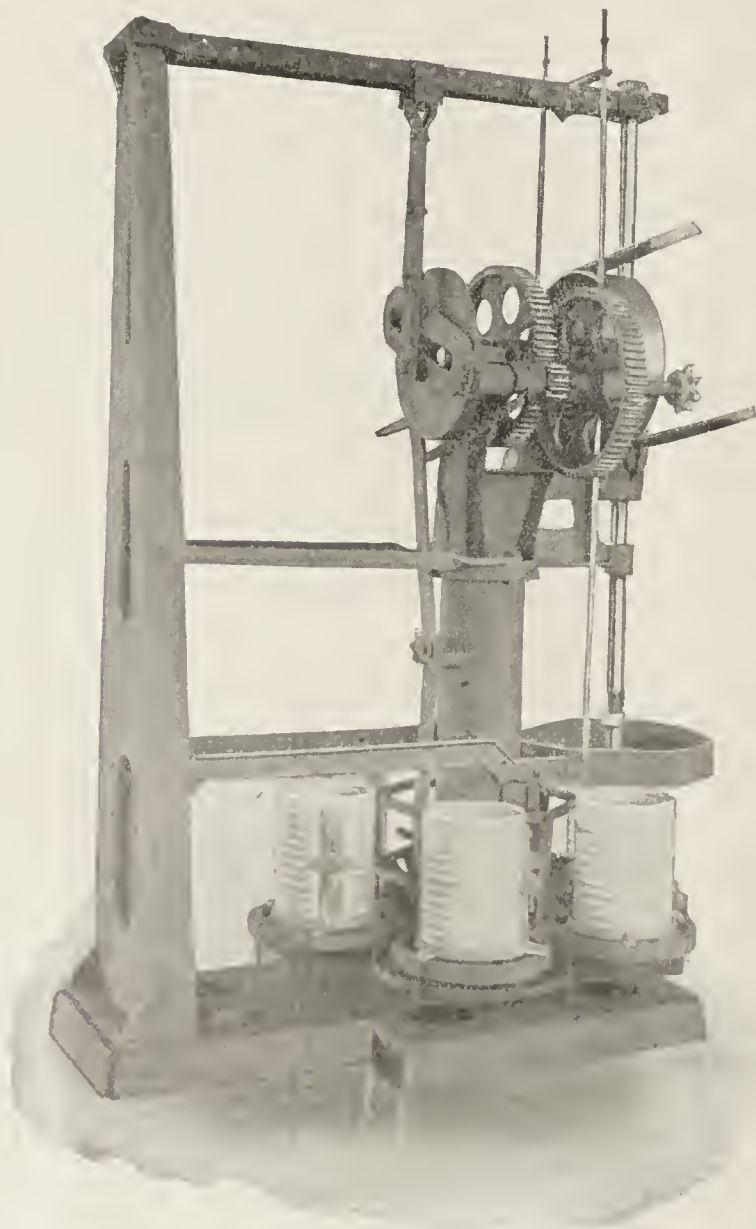
WOOD STILL PRINCIPAL MATERIAL USED IN BUILDING CONSTRUCTION ACCORDING TO GOVERNMENT REPORT.

Great as the advance in fire-proof construction has been during the last ten years there has been no let-up in the use of lumber, and both architects and builders find themselves so dependent on wood to-day that they are compelled to admit that the forests of the country are likely to be the chief source of building material for many years to come.

"The use of cement, terra cotta, brick and stone, with a framework of steel, will make it possible soon to do away with wood entirely," is a remark often heard, and, indeed, when one stands on lower Broadway and looks up at the towering skyscrapers, the statement seems to contain much truth. As a matter of fact, however, the popular idea that fire-proof materials will do away with the need of using lumber in a comparatively few years is a very erroneous one. All of the various fire-proof materials going into the approved construction of the more substantial buildings are used in greater quantities now than the world dreamed of a few years ago, yet the heavy demand for lumber continues.

That wood predominates is shown by the annual building records. Of the permits used for buildings erected last year, approximately 61 per cent were constructed of wood, and the remaining 39 per cent of fire resisting material, according to a report issued by the Geological Survey on operations in forty-nine leading cities of the country. These figures are the more significant when it is realized that they only represent the building activities in the largest cities; they do not take into account the construction of dwellings, stores and other buildings in the thousands of small cities and towns scattered over and not included in the forty-nine cities on which the reckoning is made.

In towns and small cities wood is usually the predominating building material and it is safe to say that if the statistics had included figures for all places of whatever size, the percentage of wooden construction would have been much greater. These figures, as a rule, are only for the corporate limits, and the suburbs of these cities have each very large amounts to be added. The cost, also, is relatively higher in these cities than in towns nearer the base of the supply.



THE NEW SUPERIOR PORTLAND CEMENT MILL IN STATE OF WASHINGTON.

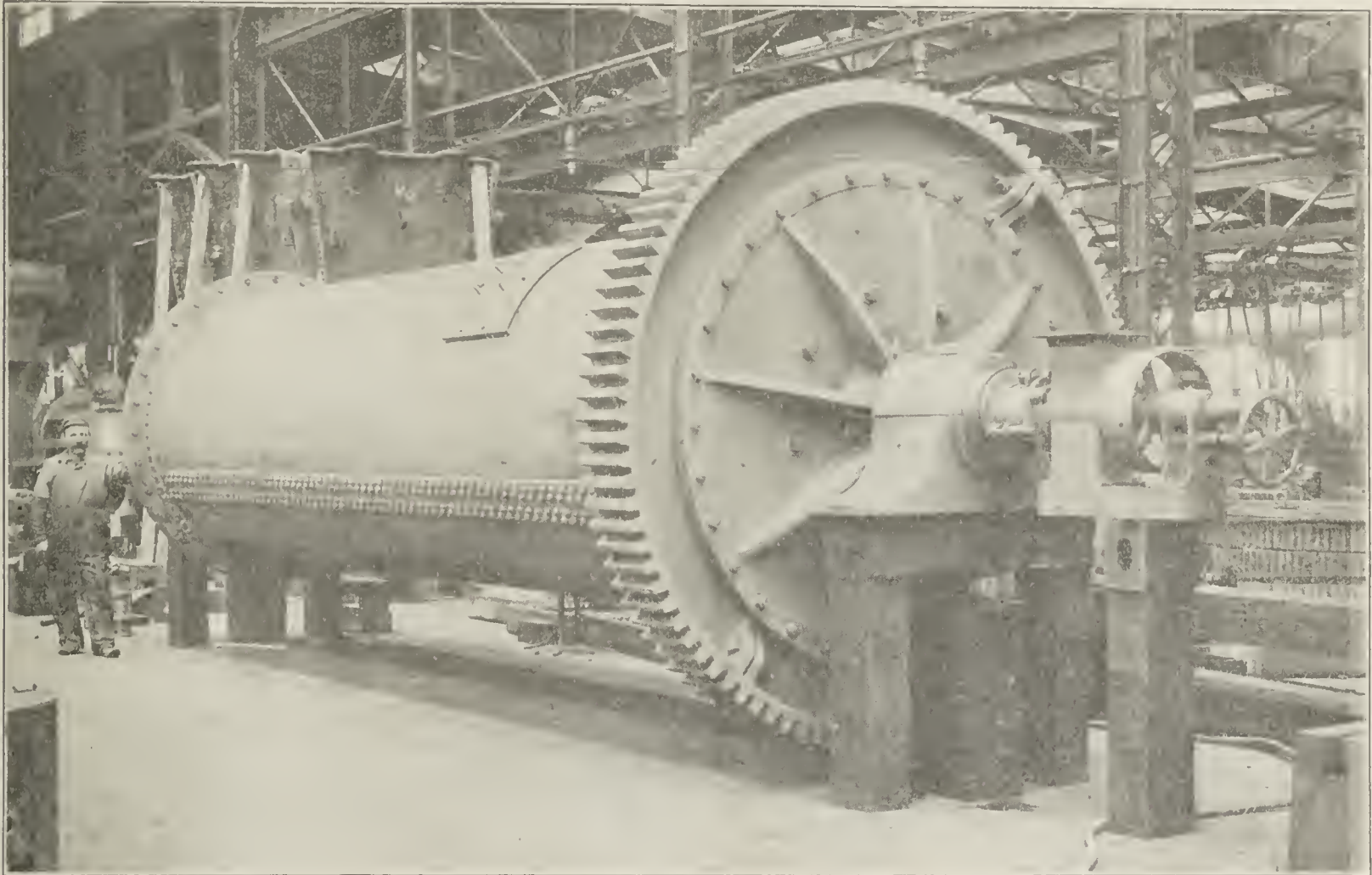
When the first carload of Portland cement, bearing the trademark of the Superior Portland Cement Company, reached Seattle early in August of this year a constant stream of glowing clinker was falling upon the concrete cooling floors of the plant at Superior, and the center of the cement industry of

to several hundred feet above it, therefore the area of them, which is 240 acres, does not convey an adequate idea of the amount of raw materials that are within easy reach of the mill.

The limestones are of a highly crystalline character, averaging very high in carbonate of lime and low in magnesia, and are a part of the same geological formations which extends from the Rocky mountains

places, as at Baker, they form veritable mountains, and at others they are found in ledges, overflows and pockets.

Suitable clays, of glacial origin, are frequently close to the limestones. The clay deposits of the Superior company rest, as the illustration shows, directly over the stone, and as they are worked out leave the stone exposed. Glacial drift forms an overburden which is



Tube mills in this plant furnished by Power and Mining Machinery Company, Cudahy, Wis.

the Northwest was established in Washington.

The first clinker fell from the kilns on July 25th, and the first cement was made on July 31st. A week later, August 6th, the first car was loaded and billed to Seattle.

The plant of the Superior Portland Cement Company is located near Baker, Skagit County, Washington. It is on the Anacortes and Rockport branch of the Great Northern Railroad, and may be reached without change from Bellingham, or by change at Burlington from Seattle or Anacortes. It is 102 miles from Seattle, 41 miles from Bellingham and 36 miles from Anacortes. Besides the railroad the Skagit river affords transportation facilities at certain seasons of the year.

The factory site embraces 80 acres, with 2,600 feet along the railroad. The deposits of clay and limestone are on both sides of Baker river, and may be worked from beneath the level of the river

westward through Vancouver island. They are uniformly rich in lime, and poor in magnesia. They make the finest of lime, and during the rapidly increasing demand for Portland cement have been eagerly sought for under favorable conditions and in accessible localities. In

shoveled or sluiced off. The average analyses of the raw materials are given below:

Limestone—	Per Cent.
Silica	6.22
Iron and alumina oxides	2.06
Calcium carbonate	90.36
Magnesium carbonate	0.82



Eastern view of plant elevated track and storage bin.

The analysis of the clays place them on the normal class, and reveal percentages which are very much the same as the normal clays of California and New York.

Clay—

Silica	58.34
Alumina	17.14
Iron oxide	9.76
Calcium oxide	3.82
Magnesium oxide	3.19
Carbon dioxide, etc.	7.14

rock is crushed to pass a 1½-in. ring and is stored in a 2-compartment bin, having a capacity for 2,000 tons. The rock bin discharges on to a pan conveyor installed in a concrete tunnel, and from the conveyor it is elevated and flows by gravity to a Ruggles-Coles dryer, thence elevated and distributed to the feed bins of three Williams mills.

The Williams mills each have a

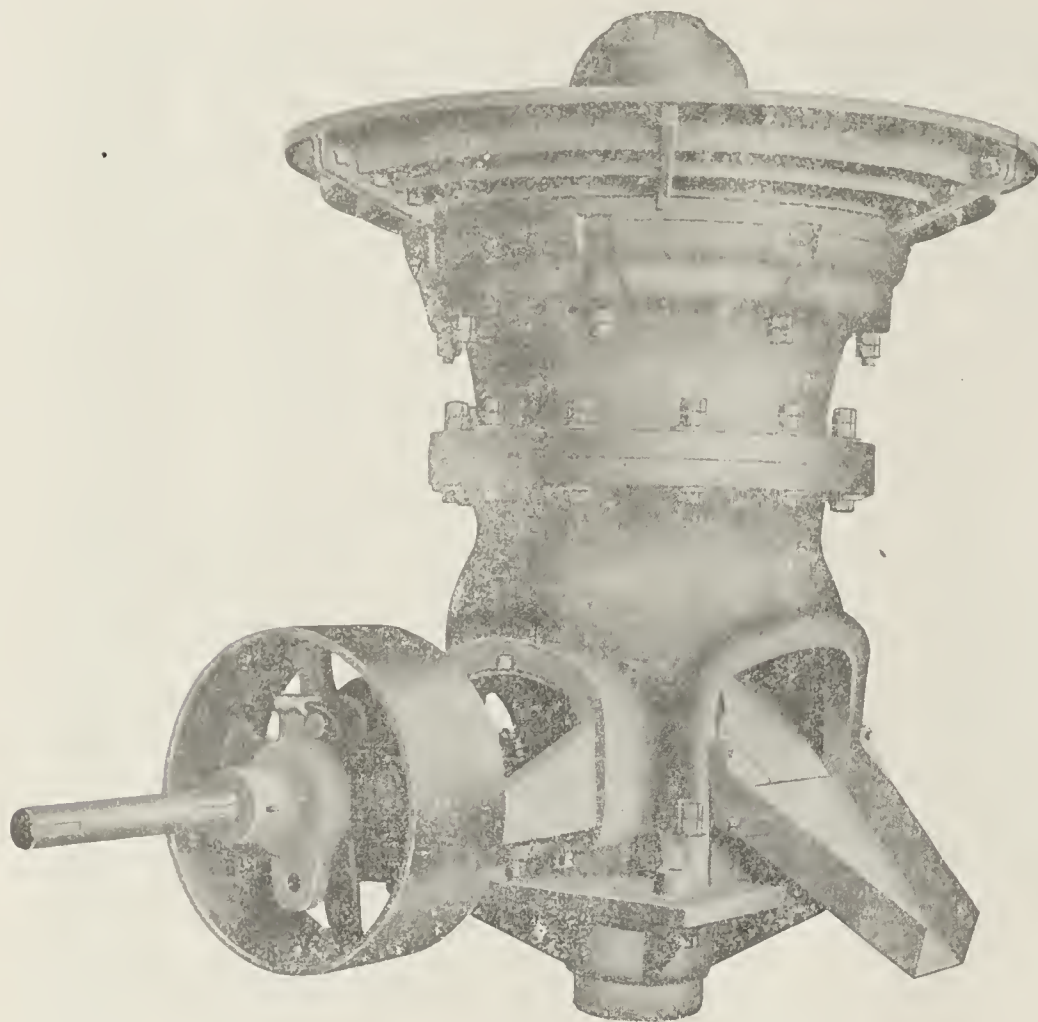
dumped into bins capable of storing a 24-hour supply.

The clay and stone, now thoroughly dry and ground, are fed from their respective bins, by means of screw conveyors, to the weighing hopper mounted on Standard scales. The scales which are manufactured by Richardson Scale Co., are electrically connected and automatically cut in or out the discharge from the different bins. The weigher releases the charge by means of a lever close at hand; the mixture is picked up by a bucket elevator which delivers it to a screw conveyor, thence discharged into the hoppers which feed the tube mills.

The tube mills are manufactured by the Power & Mining Machinery Co., Cudahy, Wis. They are 6 feet in diameter, 22 feet long and are geared to make 23½ r. p. m. The mills are lined with silex and the grinding is accomplished with Belgian pebbles. An improved patent feed head made by Geo. S. Emerick mill, increases the mixing and Nazareth, Pa., attached to each grinding efficiency. The raw mix as it leaves the tube mills is ground to pass 98 per cent through No. 100 and 95 per cent through a No. 200 sieve.

A screw conveyor picks up the output of the tube mills, and delivers it to the boot of a bucket elevator that in turn raises it to a screw conveyor which conducts it at right angles to the axis of the mill and distributes it in 15-hour steel-feed bins over the kilns.

The feed bins discharge by means of a screw conveyor and spout to the kilns; the feed of the conveyor is automatically controlled by the speed of the kiln. The kilns were made by Mosser & Son, Allentown, Pa., are 125 feet long 7½ feet in diameter for the first 50 feet from the discharge end, and then taper to a 7-foot bore at the receiving end;



McCully Crushers installed in this plant by Power & Mining Machinery Company, Cudahy, Wis.

The clay deposit is at present being worked by hand. The material is shoveled into small dump cars and discharged into a chute which takes it down into 6-ton hopper-bottom mill cars. The limestone is drilled with compressed air, shot down, and loaded by steam shovel into the same capacity cars as the clay.

The clay is dumped first, as it comes into the mill, and goes directly to a disintegrator of the roll type. From the disintegrator the clay is taken by a belt conveyor to an oil-fired Ruggles-Coles dryer. The dryer discharges into the boot of a steel-encased bucket elevator, which delivers the dried clay to a screw conveyor, thence to a two-compartment storage bin with a total capacity for 10 days' run.

A No. 6 McCully crusher lies alongside of the disintegrator, under the same track, and receives the stone direct from the cars. The

capacity of from 9 to 10 tons per hour through a 20-mesh screen. The output, however, will pass 50 per cent through No. 100. From these mills, which perform the first stage in the grinding of raw materials, the stone is elevated and



Pipe Line and Bear Creek near Headworks.

are mounted on four sets of idlers; lined with silex and Anaconda aluminum brick; are fired with fuel oil, and geared to make a revolution in 50 seconds. They were shipped from the East in two sections.

The fuel oil enters the kilns through two burners at a temperature of about 160 degrees F. and under a pressure of 50 pounds. A boiler has been installed for the purpose of steam-heating the oil and a No. 6½ blower furnishes the required and necessary pressure of air.

As the clinker leaves the kilns it falls into concrete pits and slides into the boots of two open bucket elevators. As the elevator buckets start upward a jet of cold water plays upon them and a large percentage of the heat is carried out in steam. The elevator buckets discharge through swinging spouts into two large concrete storage bins, capacity 25,000 barrels of clinker, where the final cooling takes place.

The clinker is drawn off at the bottom of the storage bin and passes through a concrete tunnel on a pan conveyor to an elevator which raises and discharges it into a Rugles-Coles dryer or cooler as conditions may require. If the clinker is coming through hot the dryer can be converted into a cooler; this change will not often be required, as the unusually large clinker storage capacity provides a wide margin of time, which is most desirable

at this stage for the ageing of the product.

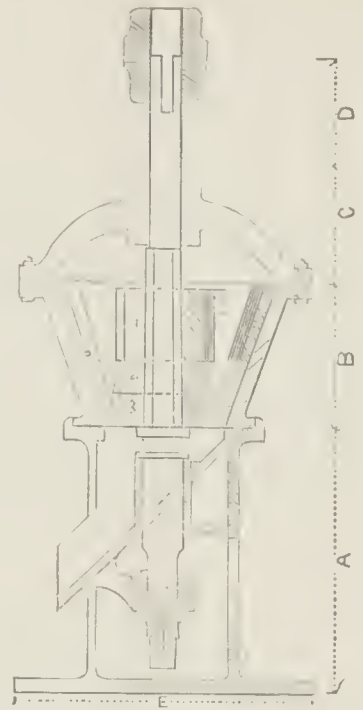
The clinker from the dryer passes through a Mosser cracker and is elevated to a storage bin immediately over Standard scales. The same elevator which lifts the clinker lifts also the gypsum, which is diverted into another bin opposite that containing clinker. The clinker and gypsum bins discharge through lip gates into the weighing hopper a lever releases the charges, which is picked up by an elevator and delivered to the bins immediately preceding the ball tube mills.

The ball tube mills, manufactured by the Power & Mining Machinery Company, Cudahy, Wis., are of the kominuter type and comparatively new to Portland cement practice in the United States, this being the second mill to use them. They are 8 feet long and 8 feet in diameter, and use steel balls for grinding.

This type of grinder is easily adjusted to the gradability of the material, and in combination with screens gives a regular product of the desired fineness.

From the ball tube mills the partially ground cement is elevated and passes over screens; the oversize is returned to the mills and the undersize or material is reduced to the proper fineness flows by gravity to the feed bins over the tube mills.

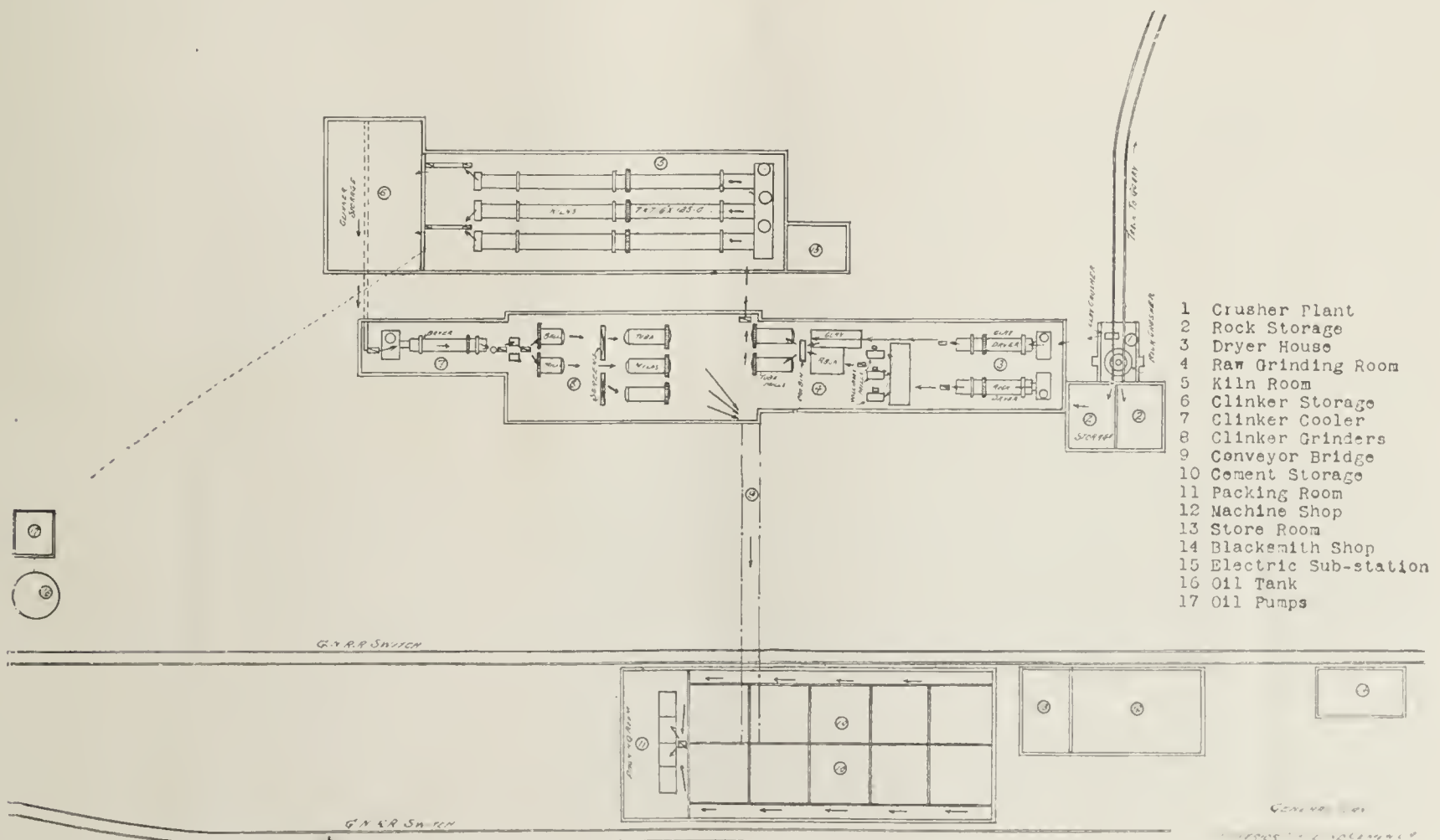
The tube mills used in the second and final stage of reduction are exact duplicates of the mills used in



Sectional view of Crusher intalled in this plant by W. F. Mosser & Son., Allentown, Pa.

the raw end. The finished product as it comes from the tube mills will pass 97 per cent through No. 100 and 85 per cent through No. 200 sieve. The cement from the tube mills is carried away by a screw conveyor and elevated to air separators, manufactured by Geo. S. Emerick, Nazareth, Pa. The oversize from the separators is returned to the tube mills and the undersize is received by a screw conveyor, elevated and taken by another screw conveyor to the stock house.

The stock house contains ten bins of 2,500 barrels each. The cement enters the bins at the center and



Ground Plan showing general distribution of machinery and process of manufacture.

bottom through a spout with openings at different elevations, which admits filling by steps and keeps down the dust.

The bins open on to screw conveyors along both sides of the house and feed into a cross conveyor, from which the cement is elevated and distributed to the hoppers of the Richardson sackers, made by Richardson Scale Co., 3 Park Row, New York, N. Y. Standard scales are at hand to check the sackers, and every package leaves the mill with full and uniform weight.

The raw materials are checked in the quarries, and the proportions are fixed from analyses made of regular samples taken from the clay and limestone after they have passed the first stage of reduction. From this on mechanical tests and chemical analyses check the working of the machines and the quality of the product they are turning out; the green cement is sampled every hour and all finished cement is held for the completion of the 7-day test.

General averages of analysis and tests follow:

Cement—	Per Cent.
Silica	24.63
Iron and alumina	8.56
Calcium oxide	62.88
Magnesia oxide	1.60
Sulphur trioxide	1.33
Fineness—	
Through No. 100 sieve	97.8
Through No. 200 sieve	85.3

Setting Time—

Initial	1 hr. 55 min.
Final	6 hr. 10 min.
Soundness	O. K.

Tensile Strength—

Neat	1 day..308 lbs. per sq. in.
	7 day..645 lbs. per sq. in.
	28 day..765 lbs. per sq. in.
Mortar	7 day..240 lbs. per sq. in.
	28 day..325 lbs. per sq. in.

The arrows on the ground plan give the direction in which the

materials move during the process, and a list of the principal machines, given in the order in which they take up the manufacture of the cement, are given below:

Clay end: 1 set disintegrator rolls, 1 Ruggles-Coles dryer. Limestone end: 1 No. 6 McCully crusher, 1 Ruggles-Coles dryer, 3 Williams mills. Mixture 2 tube mills, 3 kilns 125 ft. long, 1 Ruggles-Coles dryer, 1 Mosser cracker, 2 ball tube mills, 2 screen, 3 tube mills, 2 Emerick separators.

erty was furnished by the Power & Mining Machinery Company, Cudahy, Wis.

As designed, the plant economizes ground space and labor, and yet allows of easy expansion any time without interfering with the output of cement. A glance at the plan will show how the raw materials pass up to the center of the mill, are diverted through the kiln room, where they are burned to clinker and then brought back again to the center of the mill. From the center



General view of the camp and plant of the new Superior Portland Cement Works.

Kilns, cracker,
Tube mill,
Air separator,
Grinders, V
Cement Pa

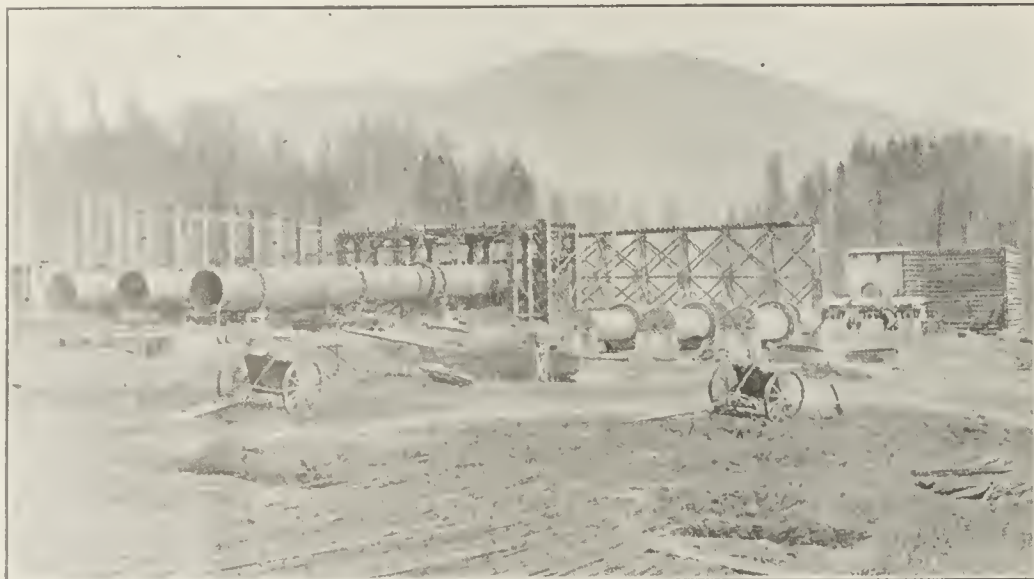
All the important machines are driven by individual belt for flexible shaft connected motors, ranging from 100 h. p. down to 10 h. p. A total of 23 are installed about the plant.

The kilns and grinding machinery

the green cement is conveyed to the stock house. When the plant is to be increased in capacity kilns will be added to the north side of the present room, and the mill will be extended in the opposite direction. Ample provision has been allowed for stock house room paralleling the railroad.

The mill building, frame construction, occupies a ground space of 125 feet long by 40 feet wide at the raw end and 50 feet wide at the clinker end. The kiln building is constructed entirely of reinforced concrete and covers a space 165x55 feet. The transformer station, attached to the east end of the kiln room, is of concrete, and occupies a space 25x30 feet.

The machine shop, fully equipped with all the necessary tools, is just east of the stock house and parallels the railroad; next beyond is the blacksmith shop; both buildings are frame. The fuel oil is received



Kilns and grinding machinery made by Power Mining Machinery Company, Cudahy, Wis.

in tank cars from the Seattle storage tanks of the Union Oil Company of California, and is tapped into a sub-surface cylindrical steel tank having a capacity for 5,000 barrels. From the receiving tank the oil is pumped through the steam heater, thence to kilns and dryers in both ends of the mill.

The operation of the plant gives constant work to over 100 men, distributed as follows:

Quarries, 40; raw mill, 12, kilns room, 4; clinker mill, 10; packing

the American Savings Bank & Trust Company, Seattle.

Mott Sawyer, secretary, was with the operating department of the Great Northern for several years, and is now giving his whole time to the general offices of the cement company.

The trustees consist of the officers and E. E. Caine, W. D. Hofius, D. A. Robinson, J. F. McElroy and F. T. Sherman.

R. J. Kellogg, manager who designed and constructed the plant

is an Englishman by birth and training, with a few years of experience in America.

The Hydro-Electric Plant.

Power is derived from the streams Sulphur, Rocky and Bear creeks; Sulphur, at a point 600 feet from Rocky has been diverted into it by a ditch, both flowing to a point about one mile from Bear creek, where the natural formation of the bedrock has made possible the erection of an extremely strong dam and a large reservoir which is



Company at Baker, Washington, which was a dense forest in 1907. Machinery furnished as follows:—
 Mosser & Son., Allentown, Pa.
 Fishers, Ball mills, Power & Mining Machinery Co., Cudahy, Wis.
 Emerick, Nazareth, Pa.
 Cement Crusher & Pulverizer Company, Chicago.
 Scales, Richardson Scale Company, New York.

house, 13; repair gang, 3; laboratory, 6; mill office, 4. Total, 92.

The surplus is used, as necessity requires, at various points about the works, and constant shifting of men runs the roll up to 100.

The personnel of the company, both at the mill office and at the general offices, American Bank building, Seattle, is exceptionally strong.

John C. Eden, president, was for a number of years prior to becoming actively engaged in the manufacture of cement, assistant general traffic manager for the Great Northern at Seattle.

George W. Dickinson, vice-president, was formerly general manager for the Seattle Electric Company.

Michael Earles, treasurer, is well known as one of the principals in the Puget Sound Mills & Timber Company, and also as an officer of

came direct from Nazareth, Pa., the heart of the cement industry of the United States, and is the man that company credits with having established a record in cement plant construction in the Northwest. Owing to his resources and untiring energies, cement is on the market several months ahead of scheduled time.

Edward Dinan, chief chemist, was formerly director of cement laboratories of the Edison Portland Cement Company, and later special investigator at the Edison laboratories.

Archibald S. Downey, chief engineer, is a consulting civil engineer, with offices in the Bailey building, Seattle.

R. A. Blake, foreman, is Mr. Kellogg's right-hand man, and is another of ripe experience in the Pennsylvania cement mills.

W. H. B. Wight, chief electrician,

tapped by a flume and ditch a distance of about one mile into Bear creek, which empties into the reservoir at the main dam, situated at an elevation of 450 feet above the power station, at a distance of 2,800 feet. A continuous stave pipe of 36 inches diameter is used from the dam to within 200 feet of the power house, where a sheer drop in the bedrock necessitates the use of a 30 in. steel pipe.

The power station contains two Pelton water wheels with a capacity of 750 h. p. each, coupled to two 600 kw. Electric alternators.

The electric system consists of two 600 kw. generators, generating 12,000 volts at 60 cycles, three phase each connected, controlled by switch gear time limit relay type.

The transmission line is nine miles long, and consists of No. 2 hard drawn copper triangularly spaced 40 inches apart.

The main sub-station has three single phase 600 kw. transformers, connected up in three phase mesh, stepping down from 11,000 volts to 550 volts, to a switchboard, having panels for distributing to every part of the mills, each mill being a separate unit, operated upon its own line wires from the sub-station by mill type circuit-breakers and auto starters, all the motor equipment consists of 5 100-h.p. motors, 3 75-h. p. motors, 9 50-h. p. motors, 3 30-h. p. motors, 1 15-h. p. motor, 2 10-h. p. motor.

The electric railroad for hauling the rock from the quarry to the mills has been carried out on the overhead system, while in the quarry the third rail will be employed.

The lighting system of the mill and Superior is operated from the main sub-station, and is transformed from the power bus bars at 550 to 220 and 110 single phase.

The quarry sub-station has a branch transmission line at 11,000 volts, and two step down transformers connected up in V supplying the air compressor motors and quarry.

The Baker town-lighting sub-station, at present under construction, is also on the 11,000 volt transmission branch to the quarry, and has capacity sufficient to supply the town, saw mills and various new industries with lighting and motive power.

The City of Portland, Oregon, is making an investigation of Reinforced concrete water pipe, under Chief Engineer, D. D. Clark of the City Water Department, surveys are under way for a new water conduit system from Bull Run to the City for which reinforced concrete pipe is to be used if found satisfactory.

The cement manufacturers in the State of Washington have been barred from supplying cement for work carried on under the board of public works of the city of Seattle, Wash., under a clause in the city specifications which prohibited the tender of cement which had not been tested and in use on work for three years, these specifications have been changed to admit of the use of cement manufactured in the State of Washington, independent of the three year test and use.

CONCRETE DRAIN TILE.

Opinion of I. O. Baker, Professor of Civil Engineering, University of Illinois, as to their Merits.

Messrs. Nichols & Wence, concrete tile manufacturers of Farmer City, Ills., being desirous of information, obtaining the opinion of Prof. Baker, wrote to him asking as to the comparative strength of concrete and clay tile, also as to concrete tile deteriorating while in the ground, also whether our soil contained any acids

injurious to concrete tile. The following is his answer:

Champaign City, Ill., Nov. 13, 1908.
Nichols & Wence, Farmer City, Ill.

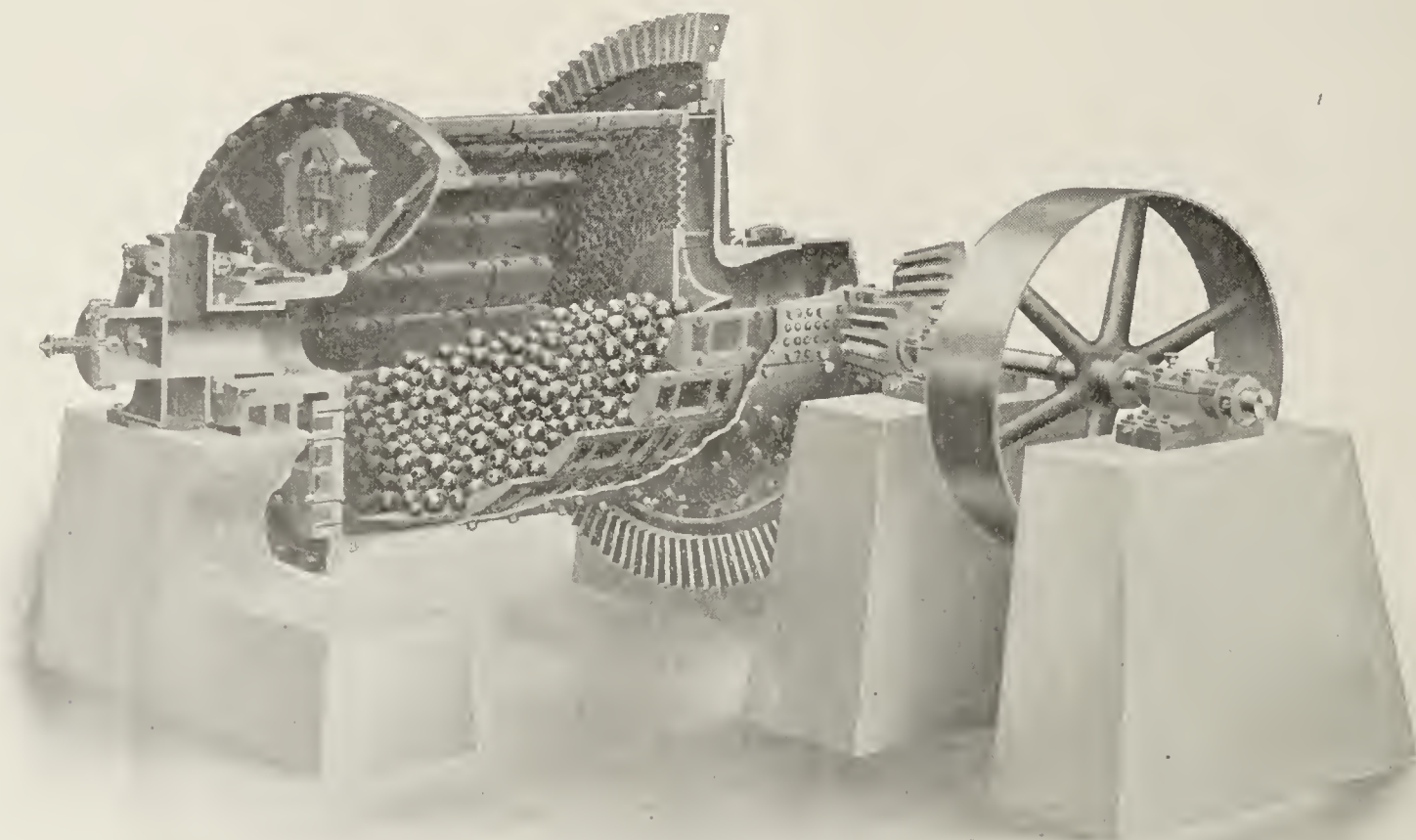
Gentlemen:—In answer to your letter of the 11th, permit me to say that I have made no experiment on the strength either comparative or absolute of either clay or cement tile. I do not think you need to worry about either being weak if reasonably well made, and I do not think there is any reason to worry about concrete drain tile deteriorating after being laid. I know that someone has written, a scare article on that subject, but his alleged facts were ridiculous and his logic erroneous. There are no acids in the soil that will appreciably if at all affect the durability of cement drain tile. Yours truly,

Ira O. Baker.

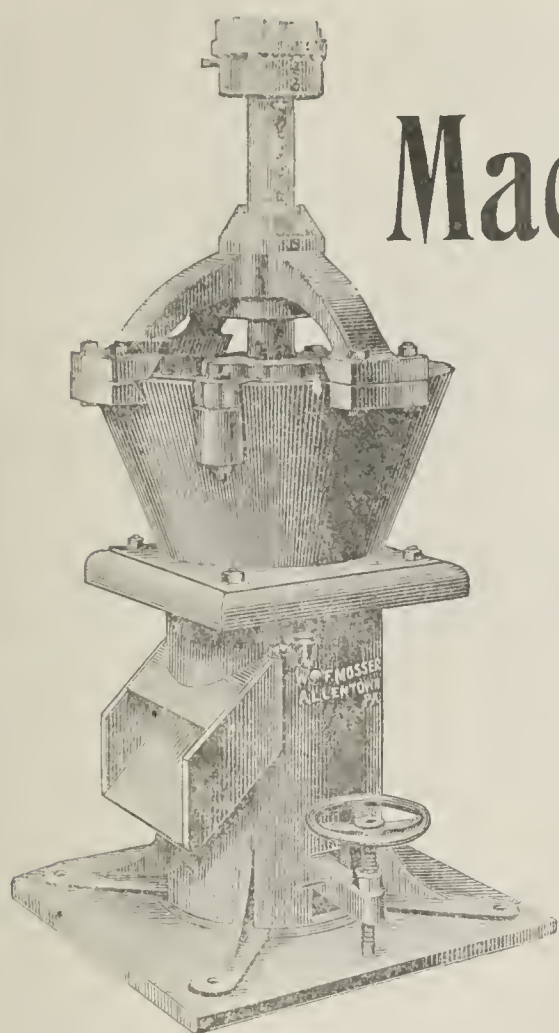
Prof. Baker is one of the leading authorities in this country on the subject of masonry and building material.

DIED.

Arthur J. McBean for many years a leading contractor who built the Reading terminal station at Philadelphia, and other large public improvements in this country and for many years a dealer in Portland cement as a side line, died on December 3rd at his home 2017 Prairie ave., Chicago. Mr. McBean was a large holder of Chicago real estate, he was one of Chicago's most worthy citizens.



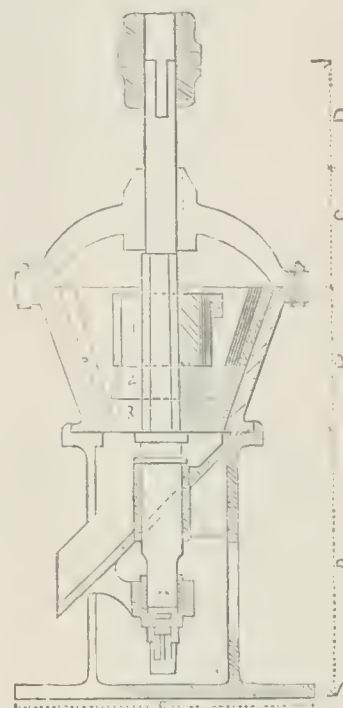
Ball Tube Mill furnished by Power & Mining Machinery Company, Cudahy, Wis.



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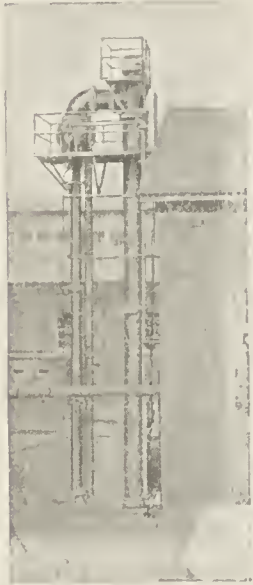
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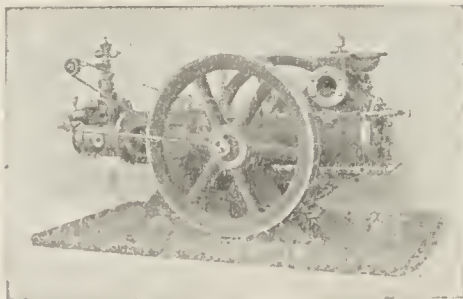
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By running your engines under vacuum you can increase the power producing capacity of the engine and boiler plant by 25%. If you are compelled to use boiler feed water containing scale forming matter or acid, a Wheeler Surface Condenser will save you the immense amount of money now spent for boiler cleaning and repair bills, since the pure distilled water represented by the condensate can be used over and over again for boiler feed.

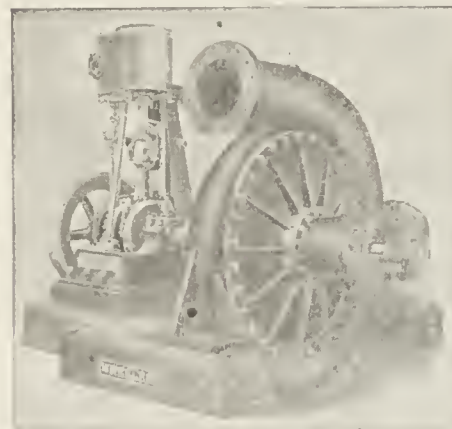
The Wheeler-Volz Condenser not only condenses all the steam and supplies a vacuum for the engine, but also

preheats the boiler feed water, so that the boilers are protected from temperature strains and the coal economy is increased. Each 10% increase in feed temperature represents 1% saving in coal. Where cold circulating water is not available, the Wheeler - Barnard Water Cooling Tower makes it possible to obtain good vacuum.



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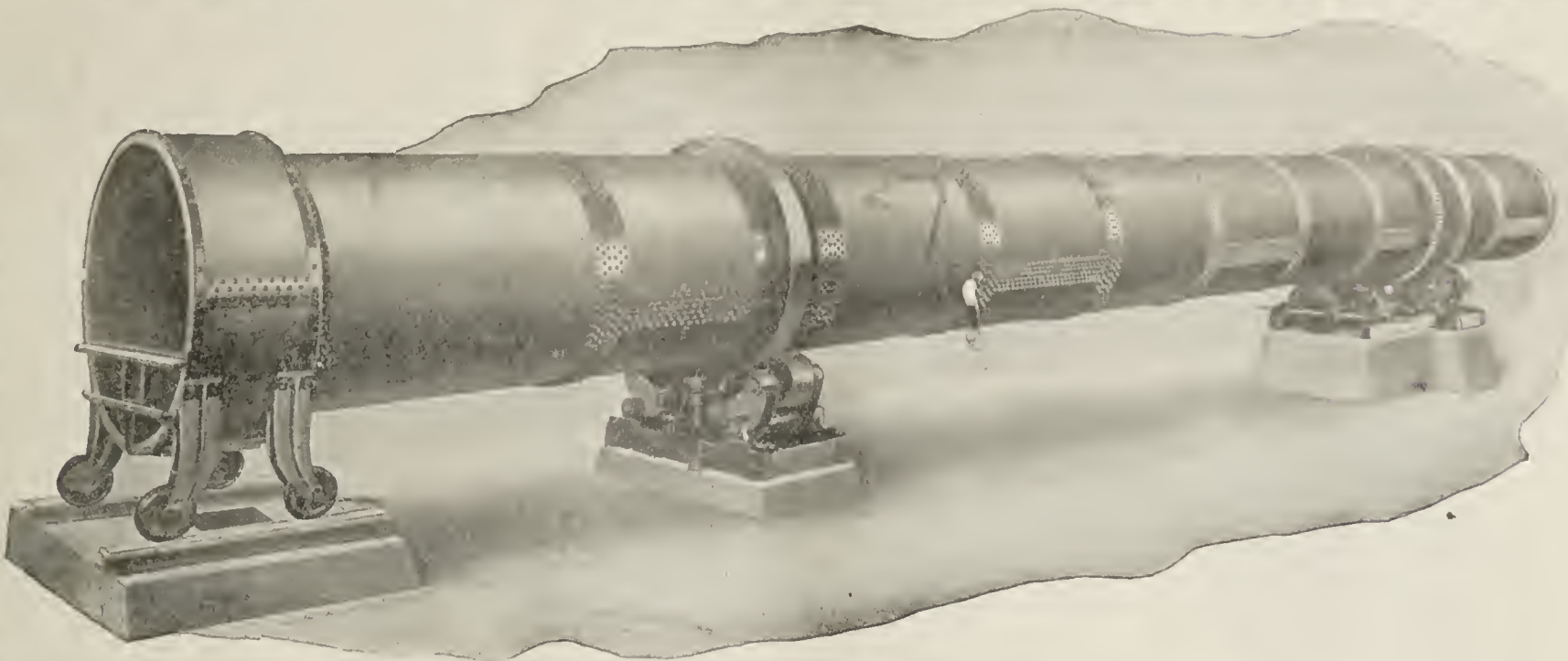
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Cement & Eng. News 10-15-08.



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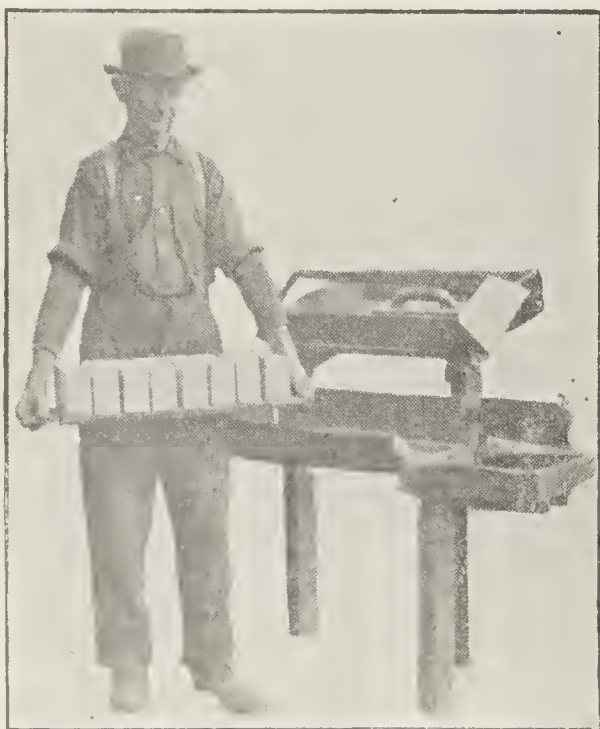
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Co.D by express 1- 12 inch tile
mold (7-ft length) quoted at
\$70.00 weight 70 lbs. We are
using the machine
I want to give yours a trial
if they prove satisfactory
We may be able to do business
with you - Kindly acknowledge
receipt of this & oblige
Yours very truly
The Monon Cement Tile Co.
Discount? By Harry A. Bond

This letter was written July 16, 1908; received July 18 and the mold shipped the same day. That the Miracle Mold need only be tried to win is shown by the following order received 3 days later:

Miracle Pressed Stone Co.,
Minneapolis, Minn.

Dear Sirs:-

We are in receipt of 10" straight Tile Mold and have given same a trial with satisfactory results. Kindly send us by express one 12" straight Tile Mold complete.

Yours very truly,
The Monon Cement Tile Co.

We want you to have our 24-page Pipe Mold Catalog. Sent free. It gives valuable information on the business in general, including experience of people who have made successes, gives reports of thorough tests of cement tile made by Iowa State College, compared with clay tile. Shows New Miracle culvert molds; Miracle man-hole mold; how to make Y's and T's from standard pipe without extra tools, and other things of practical value.

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For Grinding
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Quality unexcelled. The Recognized Standard American Brand. Always uniform.
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Manufacturers of but one grade—strictly straight Portland.
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BRODERICK & BASCOM ROPE CO.

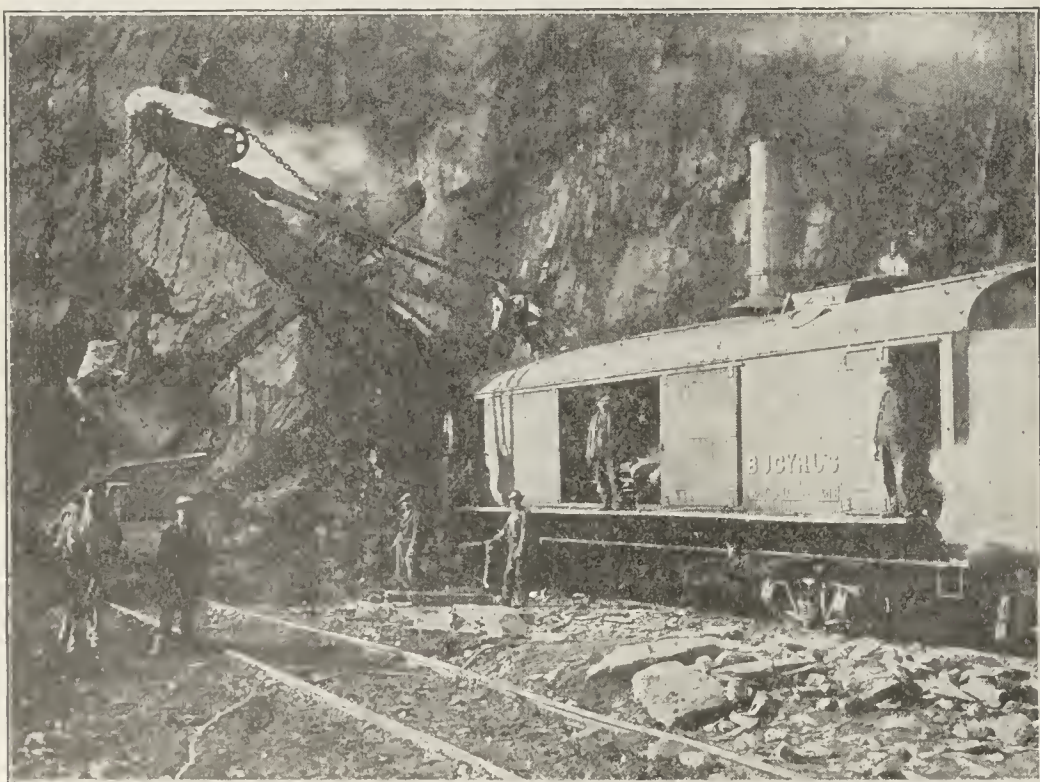
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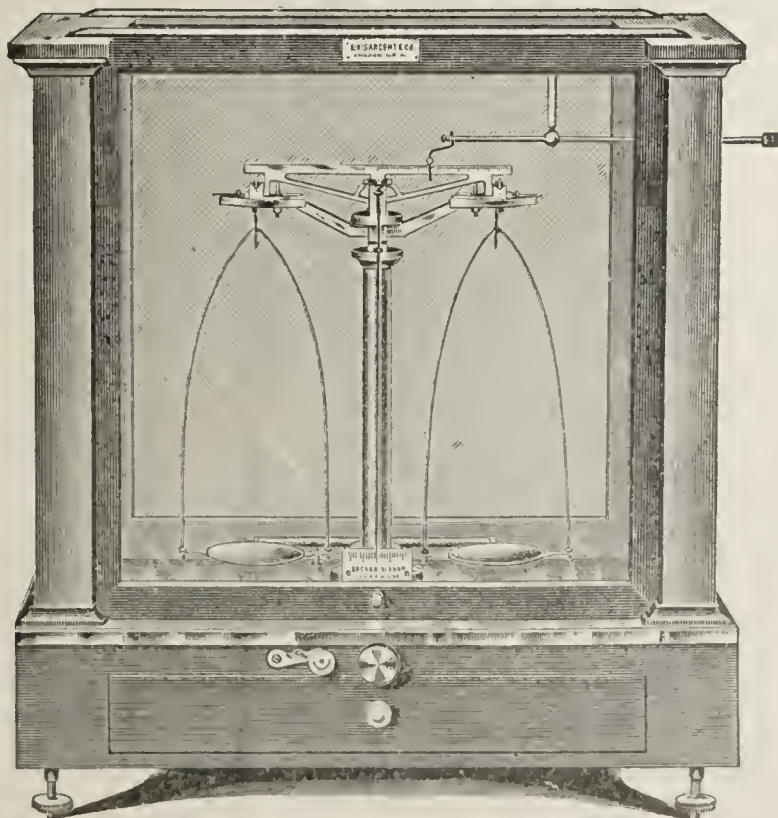
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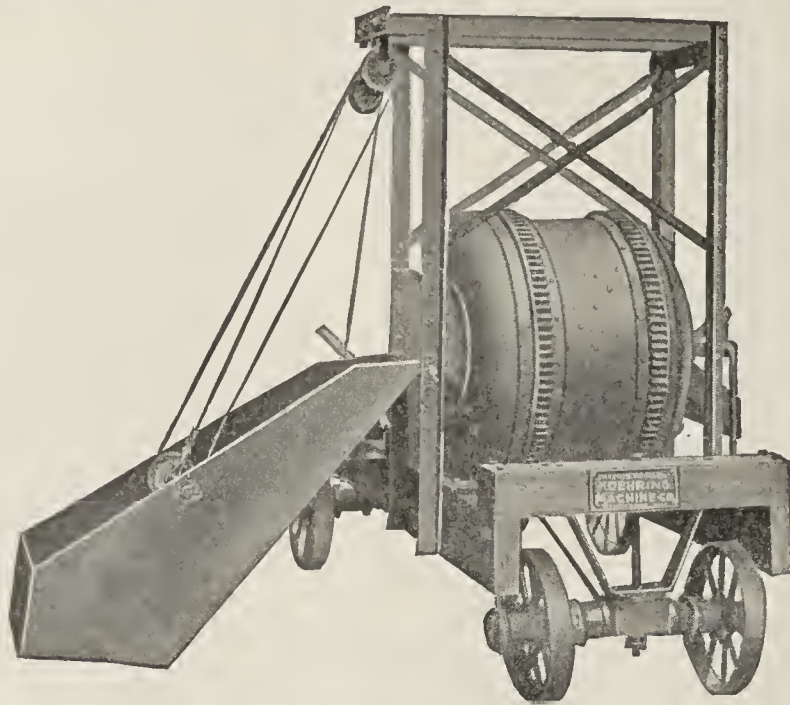
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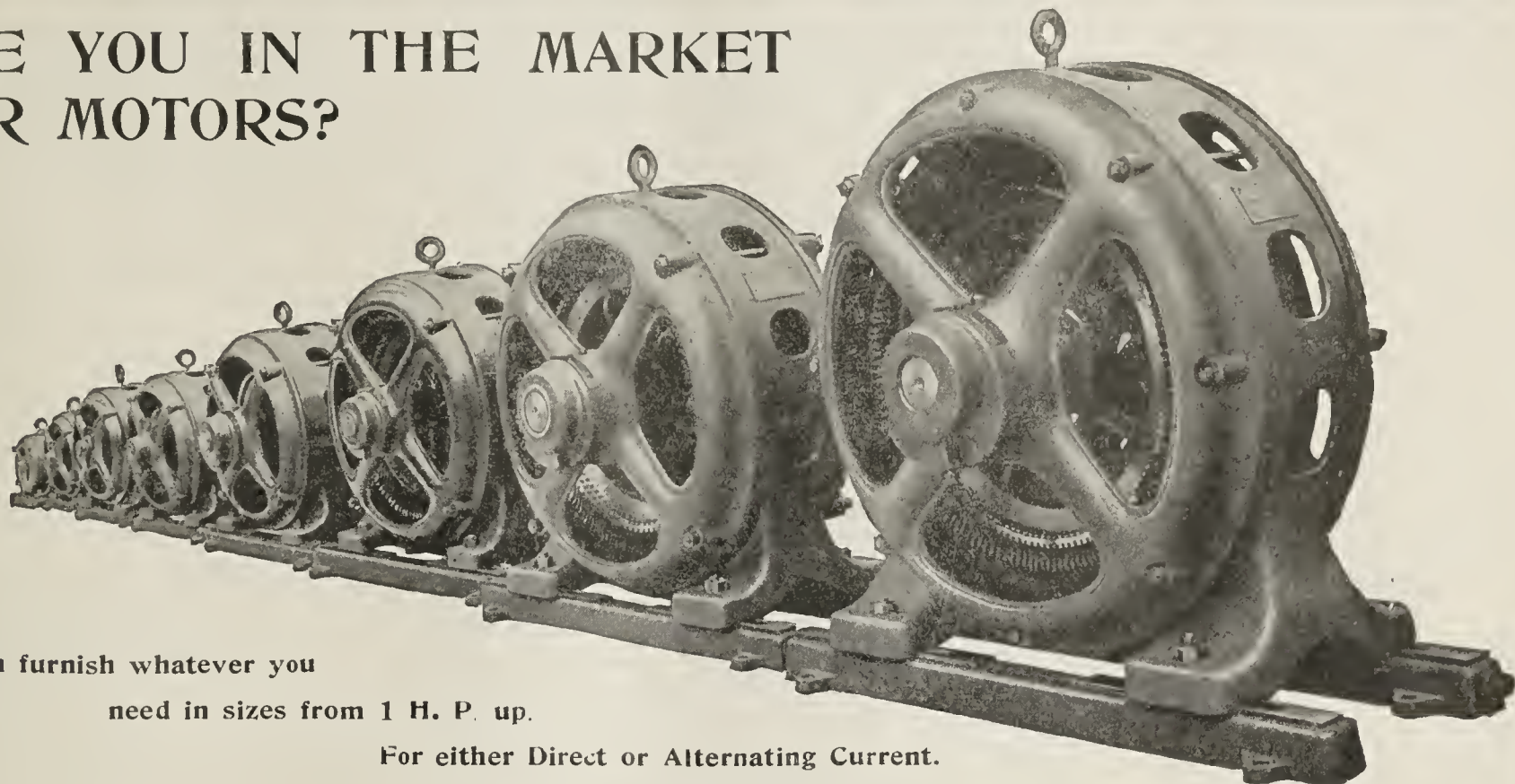
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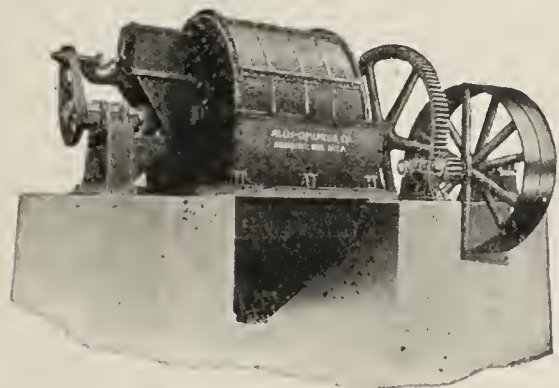
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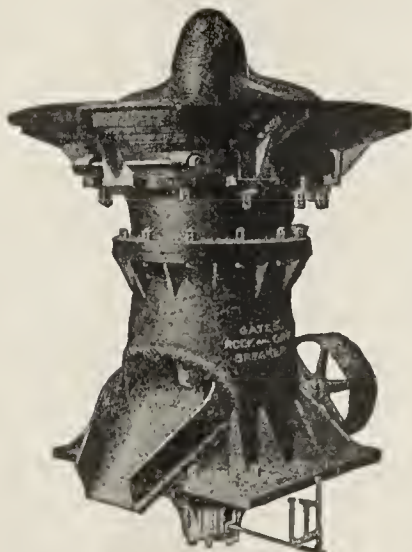
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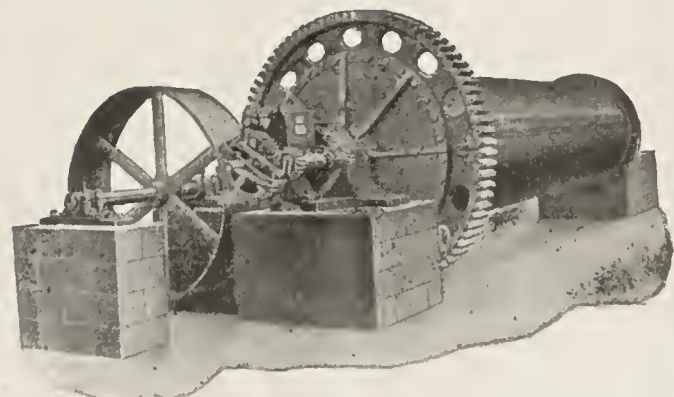
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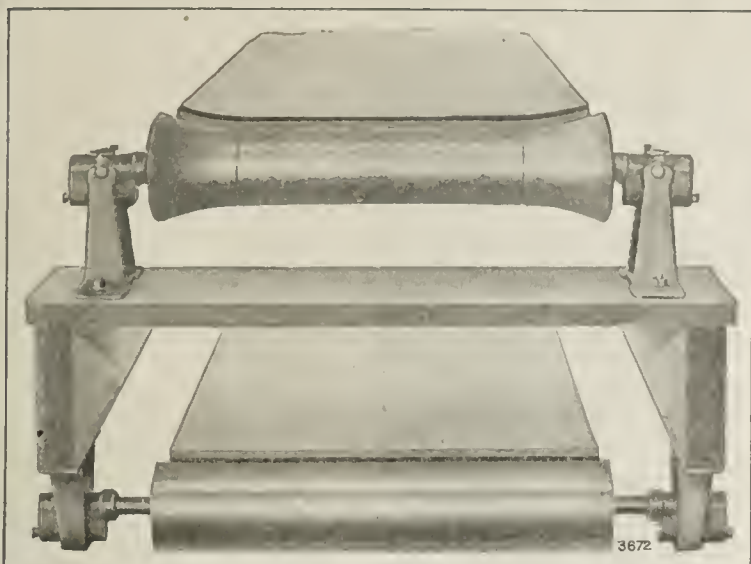
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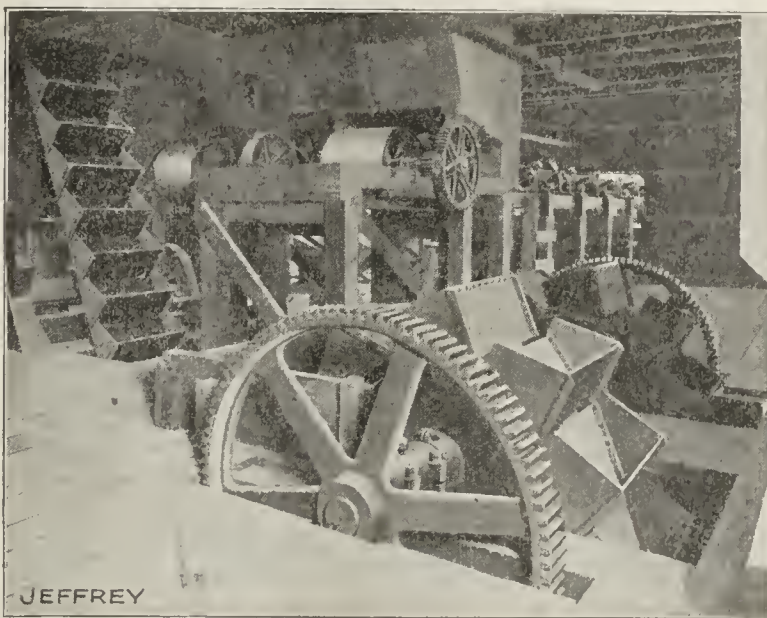
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(COPY)

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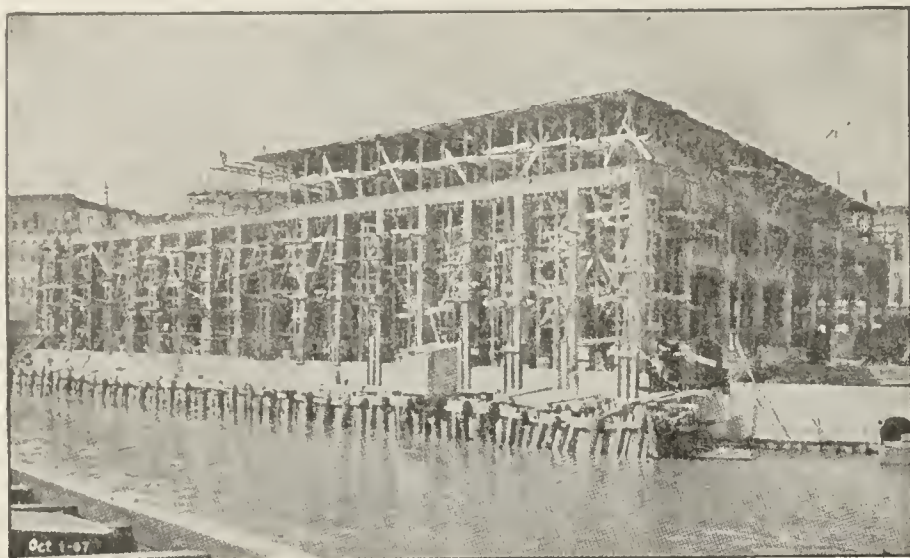
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Yours

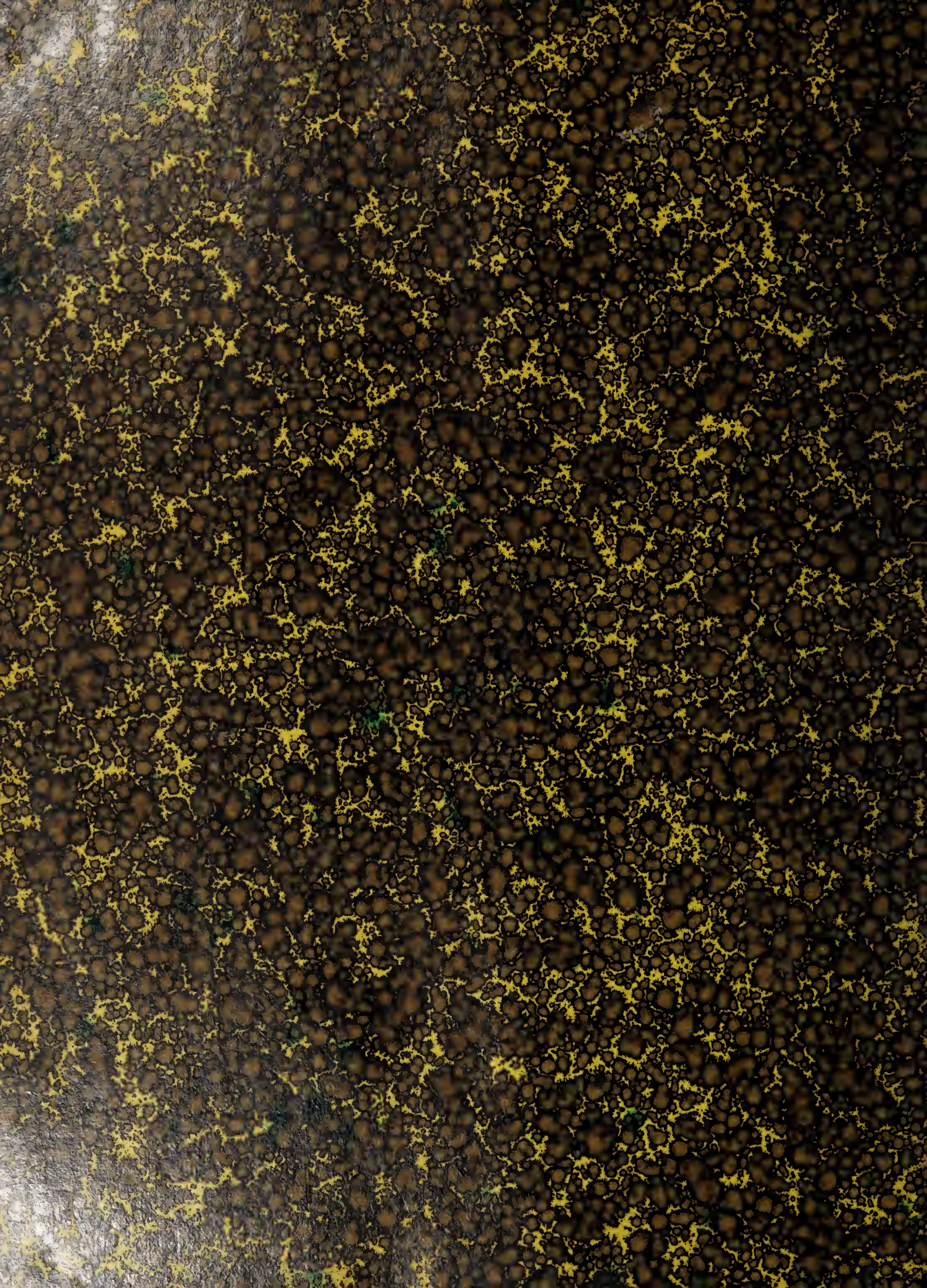
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